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AUTHOR Algava, Priscilla Snow
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ABSTRACT

The study investigated the possible correlations between brain growth stages and creative art work through the evaluation of 549 samples of children's art by children in grades K through 6. The absence of a valid instrument led to the development by the investigator of a criterion referenced rating scale for evaluation of the art work. The data clearly indicated an observable relationship between achievement in the visual arts and H. Epstein's brain growth periods. Children in brain growth spurt periods achieved higher scores than children in plateau periods. The data indicated a sharp drop in creative achievement in kindergarten and fourth grade, both of which occur during a plateau period as defined by Epstein. Appended are the detailed scoring results of the three judges. (Author/DB)

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THE RELATIONSHIP BETWEEN HERMAN T. EPSTEIN'S RESEARCH ON BRAIN GROWTH STAGES AND THE CREATIVE ART EFFORTS OF CHILDREN IN ELEMENTARY SCHOOL

A Thesis

Presented to

the Faculty of the Education Department

DePauw University

In Partial Fulfillment

of the Requirement for the Degree of

Master of Arts

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Priscilla Snow Algava

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Abstract

The Relationship Between Herman T. Epstein's Research on Brain Growth Stages and the Creative Art Efforts of Children in Elementary School

Priscilla Snow Algava

This study was designed to investigate whether there was an observable relationship between Herman T. Epstein's research on the brain growth stages and the creative art work of elementary school students in kindergarten through sixth grade in a midwestern college town.

Epstein's findings indicated that human brain growth in weight and volume occurs primarily during five postnatal periods (3-10 months, and 2-4, 6-8, 10-12+ and 14-16+ years). These periods seem to correlate with spurts in mental growth, and, particularly, with Piaget's stages of reasoning development.

The writer wanted to determine if an evaluation of the art work of elementary children would disclose a correlation between children's ages and artistic achievement, using Epstein's findings.

The study provided: 1. data on the creative art efforts of children in elementary school 2. information about the relationship between artistic achievement, age relatedness, and Epstein's periods of brain growth 3. an instrument for evaluation of children's work in the visual arts.

The absence of a valid instrument led to the development by the investigator of a criterion-referenced rating scale of 1-6. The evaluation instrument was used by three judges to score 549 samples of children's work obtained from two sections of each grade level, K-6.

The data clearly indicated an observable relationship between achievement in the visual arts and Epstein's brain growth periods. Children in brain growth spurt periods achieved higher scores than children in plateau periods. The data indicated a sharp drop in creative achievement in kindergarten and fourth grade, both of which occur during a plateau period, as defined by Epstein. Those two troughs in creative productivity correlated with other findings discussed in the investigation.

Teaching children to think creatively involves a need to know the child's current learning capacity and style and match tasks and materials to the child's cognitive level. The investigation included a discussion of the implications for the teaching-learning process which emerged from the research: 1. new knowledge as a force for change 2. determining cognitive levels 3. experiential inputs during plateau stages 4. blocks to creativity 5. substages in creative development 6. sex differences 7. the brain growth hiatus at ages 12-14 and possible "turn-off" syndrome during the junior high years 8. the arts as integrator 9. the arts and personal discovery 10. the arts and cognitive growth 11. active learning through perceptual discovery 12. manipulation of materials and cognitive growth and 13. use of the evaluation instrument by students for self-assessment and by teachers who are not art specialists.

The men who made the weapons and the men who made the paintings were doing the same thing -- anticipating a future as only man can do, inferring what is to come from what is here. There are many gifts that are unique in man; but at the centre of them at the root from which all knowledge grows, lies the ability to draw ourselves from what we see to what we do not see, to move our minds through space and time, and to recognize ourselves in the past on the steps to the present. All over these caves the print of the hand says: 'This is my mark. This is man.'

J. Bronowski
The Ascent of Man

This work is dedicated to my daughters, Carin and Alisa, who are loving, capable, creative, and independent individuals, and to my husband, Andy, my closest friend, who supported me with understanding throughout the course of this work and whose help was invaluable from beginning to end.

This manuscript is also dedicated to my parents, Rachel Schwartz Snow and Irving Snow, who gave me and my three sisters the freedom and strength to become creators, discoverers, seekers, and lovers of Learning and Life.

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Chapter I

Purpose of the Study and Statement of the Problem

How does the mind of a young person grow and develop? Herman T. Epstein's findings (1980) indicate that human brain growth in weight and volume occurs primarily during five postnatal periods which are 3-10 months, and 2-4, 6-8, 10-12+ and 14-16+ years. About 85% of all children fit into this pattern.

How might educators use resources and research to foster creative behavior in growing young minds? Particularly at this time of growth in technology and science, creative behavior is highly valued; it is imperative that teachers evaluate and stimulate creative development and output in the classroom.

In addition, teachers need support and assistance in planning educational programs for children. The teacher's role can include nurturing the creative process if a more comprehensive understanding is developed about brain growth stages and how they might affect creativity in the classroom.

Therefore, this study was designed to provide:

1. data on the creative art efforts of children in elementary school
2. information about the relationship between artistic achievement, age relatedness, and Epstein's periods of brain growth
3. an instrument for evaluation of children's work in the visual arts

(4) possible implications and suggestions for educators and for individuals interested in education and in the creative potential of children.

Researcher's Interest in the Subject

Background

The researcher, a teacher for five years of literature and humanities and then for the past eleven years of the visual arts, was especially interested in the encouragement of creativity in the classroom. The investigator believed many of the problems of learning and the classroom are, in fact, related to the problem of awakening and stimulating creative growth in students. She became involved in studying how creative development is often stifled, although with the proper climate and information, teachers can learn to nurture and support creativity.

As a teacher of an interdisciplinary humanities course at a midwestern university, the investigator became particularly fascinated with students' abilities to stretch their creative aspirations and exceed their own and others' expectations. The researcher observed students, involved in the arts, who would try what was new to them and previously unattempted and who would grow, difficult as it sometimes was. The researcher believed that art was an integral part of a student's education and sought connections between student creativity and research about achievement and artistic development.

Epstein's Research

In a discussion with a university professor, the writer first became acquainted with Herman T. Epstein's research on brain growth and was intrigued by the implications for all education. She considered the possible relationship of Epstein's findings with the visual arts. A subsequent lecture on visual perception by a local optometrist provided more data, and the search had begun.

Purpose of the Study and Statement of the Problem

Purpose

The purpose of this study is to determine if there is a correlation between artistic achievement and Epstein's research findings on brain growth spurt and plateau periods. It was necessary to provide an evaluation instrument in order to establish criteria for assessing the selected works of art.

Statement of the Problem

The writer wanted to determine if it would be possible to evaluate the art work of children in order to discover if there was a correlation between children's ages and artistic achievement using Epstein's research findings on brain growth.

During the course of the research it was found that no appropriate evaluation instrument was available. Therefore, it was necessary for the investigator to develop one.

The study:

1. used the evaluations of three art teachers to determine if there is a relationship between creative art efforts of children in elementary school and chronological age

2. developed an evaluative instrument for rating creative art work.

Hypothesis

There is no significant relationship between Herman T. Epstein's research on brain growth (rapid/plateau) stages and the creative art efforts of students in elementary school.

Limitations of the Study

The researcher found that the absence of a valid instrument for evaluation of children's art work constituted a limitation. Although the Evaluation Instrument which was used was the result of careful research and construction, it does involve a subjective evaluation. Further, validity and reliability have not been established for the instrument.

Perhaps the homogeneity of the community might also be considered a limitation of the study.

Chapter II will consider the review of literature and related research.

Chapter II

Review of Literature and Related Research

The literature on theories of creativity and stages of creative development provided a useful context within which to analyze children's art work.

For the purpose of this study, several theories were selected which were particularly significant. They are: Herman T. Epstein's research on brain growth, a summary of Jean Piaget's stages of reasoning development, a summary of Kenneth M. Lansing's work on Piaget and art, and the work of selected individuals, such as Viktor Lowenfeld and W. Lambert Brittain, on the developmental characteristics of children's art.

Literature and Related Research on Brain Growth and Cognitive Development

Epstein's Research

This section includes information about the stages of brain growth (rapid/plateau), data on the relationship between brain weight and head circumference, and facts about phrenobiosis (spurts in brain and mind). This section also reviews corresponding brain and mental growth spurts, Cattell's work (1971) on factoring general intelligence,

the increased complexity in neural networks during brain growth stages and Epstein's use of EEG data. Included is a summary of Piaget's work which relates to brain growth theory and this research.

Brain growth theory. Epstein (1979) stated: "Postnatally, the human brain grows in weight (and volume) mainly during five periods which are 3-10 months, and 2-4, 6-8, 10-12+ and 14-16+ years" (p. 3). The direct evidence for these five postnatal brain growth periods is given elsewhere (Epstein, 1978, 1979).

Brain weight and head circumference. Epstein and Epstein (1978) determined that a relationship exists between brain weight and head circumference from birth to age 18 years. Two previous studies (Winick and Rosso, 1969; Rosso et. al., 1970) had shown that brain weight is proportional to the cube of the head circumference from birth through age 3.5 years. By assembling data from autopsy records, Epstein and Epstein showed that this cubic relationship holds through brain maturation around age 18 years.

Epstein (1980) pointed out: "Of course, there are individual variations and sex differences, but the age spans as given include about 85% of all children, with each brain growth stage in an individual lasting for perhaps a half year" (p. 47).

Phrenoblysis. Epstein's work with brain growth and cognitive functioning explored various intellectual developmental stages. In "Phrenoblysis: Special Brain and Mind Growth Periods" (1974), he

stated the following:

> Human brains have periods of specially large increases in weight that are uncorrelated or only weakly correlated with periods of general body growth.
>
> We will use the term 'phrenoblysis' for the spurts in brain and mind. 'Phreno' comes from the Greek work meaning skull or mind, while 'blysis' indicates a welling-up of matter. . . .
>
> If developmental changes exist, they may occur at similar ages regardless of the actual sizes and functioning of the various individual brains. . . .
>
> This phrenoblysic age spectrum for humans might be correlated with spurts in mental abilities. On the basis of anecdotal evidence obtained by talking with teachers, we have reason to believe that the periods are correlated with spurts in learning ability. The 14-15 yr. spurt is correlated with the Piagetian stage of formal operations, which is generally supposed to initiate after age 12. The 11-yr. spurt is correlated with the rapid growth of conceptualization about concrete objects in the environment, which is utilized in schools to build in, for example, ideas about fractions and geometrical objects. The 7-yr. spurt coincides with the start of formal learning normally associated with the acquisition of reading and writing skills by the average child. (pp. 207-215)

Mental spurt periods. In the second portion of the same article, "Human Mental Development" (1974), Epstein described data from 13 independent studies "shown to give a highly consistent spectrum of ages at which mental spurts are found: these are 2-4, 6-8, 10-12 and 14-16, with an especially clear low rate of growth at 12-14 yr. These ages correlate very well with those found for spurts in brain and skull sizes" (p. 217). See Table 1 for data from 13 research works on Age of Peaks or Troughs in Mental Growth (Epstein, 1974, p. 222).

Epstein stated:

> One of the basic problems in the study of intellectual development in humans is that of ascertaining the existence of so-called critical periods. We focus our investigation on the evidence that mental growth in individuals increases in characteristic periods. (p. 217)

Epstein discussed the use of the measure schooling quotient (SQ) obtained when the GA (grade age) is divided by the chronological age (CA). The GA gives the comparison number which tells how far along the individual is in terms of the age (or grade) with whose schooling problems he can readily cope. The relatively sharp spurts sometimes get lost when dealing with GA and CA data. These spurts can be recovered from the averaged or smoothed data (see Epstein, 1974).

Epstein computed the annual, biennial, triennial (and so forth) increments to discover the periods during which all children begin and complete their phrenoblysis. He stated: "Biennial increments turn out to be adequate, and, thus, we are able to use them to detect the central age around which the spurts occur because the increment is greatest across that age" (p. 218).

Epstein (1974) also specified:

> Phrenoblysis was shown to occur in all studies of brain and skull development that have been located. In particular, spurt ages are at 6-8, 11-12, 14-17, and probably around 3-yr. Some variation exists among different ethnic groups and between the sexes, but even these variations are included in the spurt ages given above. (p. 218)

Are brain spurts correlated with mental growth? Epstein (1974) cited several studies which show clear patterns of mental growth peaks around ages 10-12 and 14-16, with a very probable peak around ages 6-8, and some evidence for a peak around 3-yr. The very slow growth period around age 12-14 is clearly indicated.

Research Related to Epstein's

Cattell's research on creative intelligence. An important apsect of Epstein's study which has special ramifications for creativity was his discussion of Cattell (1971) and his factoring of general intelligence into two subfactors, the crystallized called g_c and fluid g_f intelligence factors.

> The crystallized factor is associated with the intellectual capacity developed up to the age in question as modified by the learning and experience of the individual. The fluid intelligence factor is believed to represent the individual's current capacity for developing new patterns of intelligent behavior or learning; it is sometimes said to be the representation of creative intelligence at the various ages.
>
> Cattell measured g_c and g_f at 4 different ages. . . . The g_f in reasoning, verbal, and numerical capacities are not only minimal around age 13 yr, but are very close to zero. Thus, around the age of the trough in intelligence growth there is little or no capacity for new intellectual growth. This property is more closely linked to the capacity to learn than to the developed intelligent behavior associated with the concept of grade age. (p. 221)

Rosenthal and Jacobsen's research. Epstein also cited a second study (Rosenthal and Jacobsen, 1968) which "shows substantial SQ spurts during the school year in grades 1 and 2 (ages 6-8) and again in grades 5 and 6 (ages 11-13) in both the control and experimental groups. Thus, growth in learning capacity appears only

at ages 6-8 and 11-13, with very little, if any, such growth at the intermediate ages" (p. 221).

"These two studies, taken together, indicate that spurts in the capacity to learn new kinds of intellectual functioning may also exist and also correlate positively with spurts in mental growth demonstrated in this paper" (p. 221).

Werner and Kaplan. Epstein (1974) also discussed a study, Werner and Kaplan (1950), which revealed a rapid increase in language sophistication starting at age 11 yr. There are also strong indications that during the age 11 spurt there is an increase in the use of abstract terms and a sharp drop in sentences containing vague reference words.

Bayley's work. In 1949 Bayley's work pointed out that spurts occur at around ages 3, 6-7, and 10-11 yr.

Age-Linkage of Spurts and Troughs and Implications for Schooling

Epstein concluded:

> Every study has given support to the same phrenoblysis spectrum: spurts in GA or related parameters at ages 3, 7, 11, and 15 yr. with troughs between the spurts. Not 1 study was found with data contradicting this pattern. . . . The fact that the spurts and troughs appear so clearly is evidence of a sharply age-linked mechanism underlying the spurts.
>
> Paper I (Epstein, 1974) presented evidence for the existence of a spectrum of growth spurts in brain weight and skull circumference at the same 4 ages. Thus, the physical growth of the brain is correlated with the functional growth of the mind, although cause and effect cannot be assigned. It is difficult to escape making the working hypothesis that such a causal relationship exists. However, it is not necessary that the hypothesized relationship be in the same direction at each spurt age. Thus, for

example, the physical spurt around age 3 makes possible mental growth at that age, but it might simultaneously be true that the mental growth at age 15 is the causative age of the physical growth around that age.

Increase in GA specifies the capacity to handle certain tests and to learn certain common information or concepts. By themselves, these increases do not tell us whether the period of slow growth, such as that at age 13 yr , are times for trying to teach children more or for teaching them less. . . . The elaboration of the GA growth spectrum . . . may tell us when to attempt intensive schooling so as to be maximally helpful to children who are trying to learn.

The fact that the spurts are so readily found in the data gives substantial support to the notion that the developmental processes tend to occur at certain chronological ages fairly independently of the history of individuals. (pp. 222-223)

Epstein's work has important implications for thinking about the role of the educator during the designated intellectual development stages.

Neuronal growth and the biological basis of the Piaget stages. Epstein (1980) discussed the idea of a biological basis for readiness for functions appearing during each stage. "If the child is one whose brain growth is late in age spans given above, its readiness for the new functions will be correspondingly late" (pp. 47-48). The implications of this idea for educators will be discussed in Chapter V.

Neuronal change is an important aspect of brain growth. Epstein (1980) found the following:

The indicated growth of existing neurons occurs by elongation and branching of axons and dendrites which carry signals to and from other neurons. Such events indicate formation of new connections (synapses) between neurons, though most are likely to be the result of shifting already existing synapses from one neuron to another (Huttenlocher, 1979). Thus, we are led to infer that, during the

brain growth stages, connections among neurons change, and the changes are very substantial because an overall increase in weight of 30 percent represents a very large amount of elongation and branching. . . .

These newly complex neural networks make individuals capable of processing significantly more complex inputs. That is, at each brain growth stage, the child becomes capable of much more complex reasoning. This inference turned out to be an *ex post facto* prediction because it was already known (by others) that the earliest onset ages of the Piaget stages of reasoning development are around 6 months and 2-4, 6-8, and 10-12 years. It seems likely, therefore, that the brain growth we have been dicussing will turn out to be the biological basis of the Piaget stages. . . . Biology indicates a linkage to what I have called the *earliest onset ages* of those Piaget stages. (pp. 48-49)

Cortical changes in neural networks reflect brain growth stages and EEG patterns. In addition to brain weight findings, Epstein (1980) included EEG data to verify the inferred changes (elongations and branching of axons and dendrites). He stated:

Changes in neural networks should be reflected in the electrical properties of the brain, and changes in the outer surface (the cortex) should be picked up by surface electrodes measuring the electroencephalogram (EEG). This inference about EEG patterns can be tested by studying the developmental patterns of the EEG. . . . If we plot the average frequency in the EEG . . . we find that it increases stagewise, with peak increases occurring around ages 3-4, 7-8, and 10-12 years. . . .

We can thereby see that there is a confirmation of our inference that the brain weight increases manifest themselves in increased complexity of neural networks which, in turn, produce readily detected changes in the electrical output of the networks. (pp. 49-50)

In a related study (1979), Epstein stated: "The bio-physically based electroencephalogram (EEG) also provides evidence of the stagewise development of the brain. . . . Extremely sharp and

significant brain network changes are occurring at specific ages. . . . All postnatal brain growth stages are signalled by very marked changes in the EEG" (p. 121).

Sex differential. Epstein's work (1980) revealed an interesting finding about EEG development connected with brain growth:

> Around age 10-12 years, females increase in brain weight about three times as much as males, and the reverse situation obtains at the 14-16 year brain growth stage. If these brain weight increases really reflect the networks, a similar sex differential should appear in the EEG data. The one study (Henry, 1944) that gives data by sexes clearly shows the expected differences in the expected amounts. (p. 50)

Epstein's discussion of the brain growth hiatus between ages 12 and 14 years suggested that there will be little increase in intellectual abilities during that period. "Data at ages 12, 13, and 14 years suggest that 76 percent of children will sit through three consecutive years of being unable to handle material presented at the level of formal reasoning" (Epstein, 1979, p. 4). There is a strong possibility that such children are "turned-off" by receiving many inputs at the level of formal reasoning.

Correspondingly, Epstein (1979) stated:

> The near-zero value of the Cattell fluid intelligence factor at age 13 indicates that children have little available creative intelligence at that period. . . . In the normal course of events such children assimilate little *new* thinking capacity, and hence it might be worth postponing many learning activities until age 15, at which time the GA [grade age] growth is about 50% greater than CA

[chronological age] growth. Presumably, children could acquire the same new input at age 15 in about one-fourth the time it would take them about age 13 (p. 4).

Further consideration of this plateau period and the implications for educators will be discussed in Chapter V.

Developmental Theory

The second theory related to the research is the work of Jean Piaget. Of the many interpretations of Piaget's findings, D.W. McNally (1974) and Herman T. Epstein (1979) were chosen.

Piaget's work. McNally stated:

> Intellectual functioning is dependent on the cognitive structures available at any one time. These structures develop continually as the individual matures and interacts with the environment. . . . Piaget has been able to show that their development falls into several clear stages, each defined by a characteristic way of functioning. . . .
>
> There are a number of ways of classifying these stages, but the one below is preferred because the names are to a certain extent indicative of the characteristics of the thought processes at each of the levels.

Stages of Intellectual Development

	Approximate Age Range
Sensorimotor Stage	birth to two years
Preoperational	
(a) Preconceptual or Symbolic	two to four years
(b) Intuitive or Perceptual	four to seven years
Concrete Operational	seven to twelve years
Formal Operational	twelve to fifteen years

In "Brain Growth and Cognitive Functioning" (1979), Epstein summarized the work of Jean Piaget and his associates, showing the

existence of four main stages of development:

1. Age 0-1 years: Motor stage
2. Age 2 years: Sensorimotor stage
3. Age 6-7 years: Concrete operations stage
4. Age 10-11 years: Formal operations stage

The postulate was that there is a brain growth stage on the onsets of the Piaget stages whose ages are as classically given by Piagetians. Epstein stated: "The nature of the Piaget stages are such that there is a qualitative change in mental functioning at each of the onset stages, as would be expected if there is a very significant increase in neural network complexity" (p. 3).

Piaget pointed out that children move through these stages as the individual grows. A great deal of work has been done to point out the implications of Piaget's findings for children in school.

In interpreting Piaget, Raph and Schwebel (1973) asserted:

> Very early in the course of his investigation, Piaget recognized that the child's cognitive growth does not occur as a passive reflection or a copy of external events impinging on his sensory systems, but through his own activity, constantly structuring and restructuring his own schemata, i.e. actively constructing the world he cognizes. (p. 75)

In Chapter V, the investigator will consider the importance of the arts where the child can function as manipulator of materials, become involved in self-expression and develop the ability to use materials, and explore at his own cognitive level.

Lansing's work. The portion of Piaget's findings most relevant for art education is considered in the work of Kenneth Lansing (1966). His investigation into the child's conception of space provided insights which seemed particularly useful for this paper. Piaget broke down the second stage of development, the concrete operations period, into three substages:

1. The preparatory or pre-operational substage (lasts from about age of 2 to age of 4): Child makes first unorganized attempts at symbolic representation.

2. Stage of intuitive thought (lasts from about age of 4 to age of 7): Topological relationships within the human figure are more clearly understood and are drawn convincingly. Figures and collections of figures are assembled intuitively, without thoughtful organization.

Lansing stated:

> By the age of six or seven, however, the child's perceptual activity and his drawing have been extensive enough so that he develops a more coordinated mental image of the world. This signals his arrival at the next substage of the concrete operations period. (p. 37)

3. Concrete operations substage (lasts from about age 7 to the age of 11): For the first time, the child is able to imagine relationships between concrete objects and to organize these objects meaningfully in his drawings. Examples of children's art during this period are characterized by the kind of pictorial synthesis

from the stage of symbolic development that Lowenfeld called the schematic stage.

During this stage, the child is drawing what he conceives rather than what he perceives and his work can be described as conceptual realism. There is no perspective or depth in the drawings, and there may be several concurrent contradictory views of the same object in the same drawing, a visual impossibility.

4. Piaget's final stage of development, the formal operations period, lasts from about age of 11 to the age of 15. During this stage, the child's drawings begin to deal with abstract concepts.

Lansing further considered the implications of Piaget's work for art education:

1. A child's visual symbols are intimately related to his conceptual growth.

2. Teachers of children between ages of 2 and 11 would be more successful if stimulation deals with concrete objects and events. Children of this age cannot entertain abstract ideas, and we can only go so far in teaching aesthetics to children.

3. The development of the child's concept of space may be enhanced by causing him to engage in selected perceptual activities, such as Piaget's matchsticks problem that involves an understanding of projective space or close contour drawing or drawing a given object from several points of view.

4. "If children develop spatial concepts as a result of visual and motor action, then drawing should help to improve an individual's

concept of space, if he draws from nature. Drawing a model or a natural scene would encourage the child to increase his looking and to look more carefully, and it would reinforce his looking" (Lansing, 1966, p. 42).

5. It is possible that the nonvisual or haptic person, who cannot coordinate his partial impressions to form a mental image, could have his spatial concepts developed. Piaget's view, that a coordinated concept of the world depends on perceptual action in relation to a point of reference, could be used to help the nonvisual person to develop his spatial concepts.

Since the researcher attempted to make a correlation between indentified learning stages and creative work, the review of research included current literature on creativity.

Literature and Related Research on Creativity in Children and Artistic Development

Defining Creativity

Defining creativity has been and continues to be a problem. By the very nature of creativity, defining it becomes a challenging, if not an almost impossible, task.

Yamamoto (1965) cited a voluminous number of research efforts and conference proceedings on the nature, definition and criteria of creativity.

Getzels and Jackson (1962) discussed Schachtel's definition of creativity as the ability to remain perceptually open to the world.

Hadamara (1954) suggested that too close adherence to logic and past connections in mathematics often arrests new insights and creative discoveries. He stated, "Most striking at first is the appearance of sudden illumination, a manifest sign of long, unconscious prior work. The role of this unconscious work in mathematical invention appears to me incontestable" (p. 14).

In the act of creation there is also the element of mystery and the involvement of the creative aspects of the unconscious. June Singer (1979) used Carl Jung's description of the creative unconscious:

> However dark and unconscious this night-world may be, it is not wholly unfamiliar. Man has known it from time immemorial, and for primitives it is a self-evident part of their cosmos. . . . The primordial experience is the source of [the poet's] creativeness. . . . It is nothing but a tremendous intuition striving for expression. It is like a whirlwind that seizes everything within reach and assumes visible form as it swirls upward. (p. 69)

In the creative act, there are two aspects-both what <u>can</u> be explained and what can <u>not</u> be explained.

One may evaluate and categorize creative products, but perhaps, in the end, it is not possible to measure creativity. What can be measured quantitatively exists but perhaps creativity like a great painting must be discovered, not measured.

For the purposes of this investigation, creativity is considered as being closely related to thinking abilities, the ability to

conceive of new and novel ideas, and to attitude development, which involves the idea of discovery as its own reward but also sparking continuing exploration.

Torrance described creativity as a capacity for originality, flexibility, fluency, and elaboration. The child's knowledge, experiences and powers of awareness are the raw materials of creativity. As Torrance (1970) stated, "Art can be thought of as a continual process of creativity" (p. 45).

Artistic Development

Viktor Lowenfeld and W. Lambert Brittain (1970) stated:

> The basic ingredient of art comes from the child himself. This is essentially true whether we are talking about an elementary school child or a high school senior. The teacher has the important task of providing an atmosphere conducive to inventiveness, exploration, and production. . . .
>
> A work of art is not the representation of a thing but rather the representation of the experiences we have with that thing. Because experiences will change not only from year to year but from day to day, art expression becomes a dynamic, ever-changing process. . . . Not only is the supportive atmosphere necessary, but flexible channeling of the youngster's feelings and emotions and perceptual skills must culminate in an artistic form for the process to be meaningful. (p. 58)

Lowenfeld and Brittain believed that creative growth starts as soon as the child begins to use paper and makes marks. In doing so, he puts something of himself into his markings. There follow many steps from those first unique markings to complex creative production (p. 32-33).

Creativity cannot be imposed upon children, but must be developed in children as a spirit from within. The child reveals himself directly and without fear in his art. Art becomes a meaningful communication with himself. Art is important to the child's thinking process, his perceptual development, his emotional development, his increasing social awareness, and his creative development (p. 33-34).

Developmental stages in art. Lowenfeld and Brittain described developmental stages in art: "As children change, so does their art. Children draw in predictable ways, going through fairly definite stages, starting with the first marks and progressing through adolescence" (p. 36).

The first stage, the Scribbling Stage, usually lasts from 2-4 years of age. During this time, the child's drawing consists of random marks, which begin to become more organized and controlled toward the end of the stage.

At about the age of 4 children begin to make recognizable objects in their drawings. The third stage, the Preschematic Stage, usually starts about age 4 and lasts until about age 7. In this stage, the youngster begins to attempt representation of the classic head-feet conception of a man and of selected other objects which the child has perceived in his environment. There is great variation in the size of objects, and elements are generally randomly placed on paper.

These first three stages have a quality of spontaneity and freshness which adults find very appealing.

From about age 7 until about age 9 the child is in the fourth stage, the Schematic Stage. He attempts to symbolize his environment using a definite conception about form. The child often repeats again and again the figure that he has created for representing a man, and objects generally appear in a straight line across the bottom of the page; the work has a decorative quality.

The fifth stage, the Stage of Dawning Realism, includes children from 9-12 years and is sometimes described as the Gang Age. In children's drawing, they still symbolize, rather than represent objects. During this stage of great peer awareness, the child is also experiencing new awareness of himself which is exhibited in the drawings, which are not as large and free as the earlier work. In the work, the child also expresses a growing consciousness of himself as a member of society. Children begin to draw smaller, become interested in detail, and no longer line objects up along the bottom of the page.

Somewhere around the age of 11 or 12 the youngster enters the sixth stage, the Pseudo-naturalistic Stage, the age of reasoning. He becomes increasingly aware of his natural environment and begins to concern himself with proportion and depth in drawing. A time of self-criticism, drawings are often hidden in notebooks or are attempts at cartooning. The human figure becomes defined by great detail and includes an awareness of sexual characteristics, and sometimes the drawings reveal a greater sensitivity to differences and gradations in the use of color. (Lowenfeld and Brittain, pp. 37-39).

Lowenfeld and Brittain (1970) explained: "For some, this stage marks the end of their artistic development and we often find that adults, when asked to draw something will make a drawing that is very typical of the twelve year old" (p. 39).

Drawings reflect the child's growth as he moves from an egocentric point of view to a developing awareness of himself and his relationship in the larger world. The scribbling child's undefined shapes may express essential feelings of the self, and, as the child develops his symbol of a man he defines himself and his relationship to his environment. Perhaps this man symbol slowly takes on the meaning for him of any person.

Lowenfeld and Brittain reported that in studying children's thinking, Piaget (1959) discovered that there were stages in development that closely parallel the stages of development mentioned above.

Cohen and Gainer's work. Elaine Pear Cohen and Ruth Strauss Gainer (1976) graphically represented the developmental stages in Piaget's work on cognitive development and Lowenfeld's stages of art development. The reader is directed to that work (pp. 30-31).

Cohen and Gainer affirmed the connection between developmental stages in children's art and thinking processes and the function of children's drawings as examples of their thinking: "As can be seen from the chart, there are striking correlations between Piaget's theory of cognitive development and Lowenfeld's descriptions of drawing development. The obvious parallels attest to the validity of using children's drawings as indicators of their thinking" (p. 32).

Art is basic, not peripheral, in the education of young minds. There has been much work on the importance of art in teaching skills of organization, conceptualization, perception, development, and other skills needed for reading and thinking. In a section "Art and Cognition," Cohen and Gainer stated:

> When children create art, they also organize their thoughts and actions in patterns necessary for skill in reading. . . . Art media invite children to manipulate objects, to derive tactual and kinesthetic reinforcement in the development of perception, to organize their perceptions, and to form images. These media also provide the responsive environment that learning theorists, including Piaget, Hebb, Hunt, Montessori, and Bruner, have held essential to the development of linguistic skills. While drawing, children are inventing visual symbols. Usually they depict objects and events that are not physically present. If they are drawing things they see in front of them, they are still obliged to solve many problems in translating the seen objects into drawn forms. Accomplishing these tasks exhibits the understanding of symbols required by reading. . . .
>
> According to Susanne Langer, "The material furnished by the senses is constantly wrought into symbols which are our elementary ideas. Some of these ideas can be combined and manipulated in the manner we call 'reasoning.'" Thinking individuals, children, or adults, constantly create symbols of their experiences in order to think about them. Symbolization is necessary for thought to take place.
>
> The reasoning that occurs when children combine and manipulate symbols on paper is part of cognition. Drawing activity for young children is really "thinking out loud" - it is an easier method than the verbal style favored by adults. Writing would be impossible and articulating the words too tedious. But while words may form hesitantly, lines flow in gay abandon from the crayons and brushes of children from two to adolescence. The lines disclose much about their creators' thought processes. (pp. 64-67)

Agreement on developmental stages in art. There also seemed to be a concordance in the thinking of various theorists on the stages of development in children's art. All children develop in a sequential

movement from an early scribbling stage to a more schematic (primitive symbols) stage and then to more personalized symbolism and finally to widened experience and abstraction. (Feldman, 1970; Kellogg, 1970; Lindstrom, 1957; Lowenfeld and Brittain, 1970).

Decline in Creative Behavior at Plateau Stages

In the literature, there seemed to be some agreement about a decline in creative thinking ability and performance at about ages 5, 9 and ages 12-14 in beginning junior high school. All three of these ages occur during plateau or slow growth period, according to Epstein's stages.

Lowenfeld and Brittain (1970) suggested that society's emphasis on conforming behavior may contribute to or explain why creative behavior develops in such an uneven pattern. In view of Epstein's work on rapid growth stages and plateau periods, perhaps there are biological reasons for these dips in creative productivity. In Chapter V some of the implications and suggestions for future research will be considered.

Similarly, Torrance and Meyers (1970) contended:

> For years, students, of creative development and behavior have observed that five-year-olds lose much of their curiosity, imagination, and excitement about learning; that nine-year-olds become greatly concerned about conformity to peer pressures and give up many of their creative activities; and that beginning junior high school students show new kinds of concern for conformity to behavioral norms with the result that their thinking becomes more obvious, commonplace, and safe. (p. 69)

Torrance (1970) discussed the work of Wilt (1959) who observed that after the loss of creativity about age 9 or 10, creativity returns only for a few. She asserted that is is important to keep the gates open for its return. Others (Gorman, 1972; Guilford, 1977; Salone, 1965; and Torrance, 1967) have also noted a loss in creative thinking at age 9, or at fourth grade level.

Torrance (1967) administered a battery of creative thinking tests to samples of children from the first through the sixth grade in seven selected cultures: an advantaged, dominant subculture in the United States in Minnesota, a disadvantaged minority subculture in the United States in Georgia, Western Samoa, Germany, Norway, India, and Australia. He also studied the development of conformity tendencies in these children and engaged in longitudinal studies of creative development in order to determine the extent to the fourth grade slump and the extent to which children recover from it. His findings agreed with the other research cited in his work.

The impact of increasing social pressures, a learned emphasis on the use of the left hemisphere, and the added fact of age nine as a plateau period in Epstein's stages is, indeed, significant for understanding the fourth grader and his creative behavior.

Conclusion

The research reviewed in this paper indicated that there are identifiable cognitive and creative stages of children. This information certainly raises some questions and challenges for educators. Some of the implications will be dealt with in Chapter V.

Chapter III will delineate the procedures used in the research. This section will include a discussion of the subjects, the subject schools, the character and complexion of the town population, and the development of the Evaluation Instrument. The procedures used in the investigation will then be described.

Chapter III

Description of the Population and Procedures of the Research

The study involved 549 samples of creative art work from elementary school students in kindergarten through sixth grade in a midwestern college town. It is assumed that the children chosen represented a rough cross-section of the town's socio-economic groupings as they were randomly selected.

Subject Schools and Town Population

The representative samples were predominantly from one elementary school with a small number of additional selections from two similar schools.

The primary subject school is located in a small-sized town in western Indiana. According to the 1980 census, the population was 8,414.

Town Population

The town is known as an education and agricultural center and also has seven manufacturing plants or major industries with a total employment of 1,985. The university, founded in 1837, employs 650 people, and, in 1978, there were 1,082 farms in the town and surrounding county. Approximately 98% of the largely rural population is white and 2% black.

Primary Subject School and Student Population

The primary subject school building was constructed in 1964, having eleven classrooms, a hall library, a multi-purpose room and a cafeteria. There was a large outside play area.

At the time the data were collected 303 pupils were enrolled in the school. There were two classes at each grade level except for the fifth grade which consisted of one class.

Class size varied from 19-23 pupils, and the fifth grade class enrollment was 30. There was no ability grouping in the formation of classes.

Projects evaluated in this study were part of the regular art program and the responsibility of the art teacher. The projects were assigned to each class as a group and were executed in weekly class sessions of 45 minutes.

The students did not know they were involved in a study. The art teacher visited the students' classrooms and carried art materials with her, following her typical routine.

The researcher observed at all grade levels, kindergarten through sixth grade, to establish awareness of the kinds of art projects being assigned and the methods of execution. The researcher established rapport with the students and became a familiar figure around the school.

It was decided to study the art work of children of different ages. The principal's permission, parents' implied, was obtained to collect selected projects and rate the creative art works according

to predetermined criteria.

Evaluative Instrument

After researching the existence of an evaluative instrument the investigator found none available. Therefore, the researcher began the process of developing an assessment instrument.

First, the researcher interviewed several art teachers and obtained data on their own methods of and criteria for evaluating art work in the classroom. The investigator also consulted with an industrial psychologist who offered insights into the qualities and characteristics of creativity sought by industry.

Out of the interviews, extensive readings, and the researcher's own background and experience some common themes emerged for evaluating art work. Using this information the investigator constructed an instrument for rating creative art work. See Figure 1.

Preliminary Instrument

This original rating scale was used to evaluate 31 pieces of art work. Three evaluators worked in concert discussing first the assignment given to students, the teacher's verbal instructions and her objectives, and the characteristics which might distinguish a child's work from the others, using the rating scale.

The evaluation team then looked at the 31 pieces of art work and rating assignments were given, using the instrument in Figure 1. The session continued for six hours.

A second session, in which 26 pieces of art work were rated,

CHILD'S NAME_____ EVALUATOR_____

GRADE_____ DATE_____

TASK_____

ASSESSMENT CRITERIA: DISTINGUISHING CHARACTERISTICS

_____ 1. AESTHETIC ORDERING: Is there unity or integration of all the visual elements: color, line, shapes, texture, movement, value and composition? Is there inherent consistency within the piece itself?

_____ 2. INDIVIDUALITY: Does the art work indicate creativity, uniqueness and originality? Is it a personal statement?

_____ 3. IDEA: Does the work show evidence of a controlling idea, visual or conceptual?

_____ 4. COMMUNICATION: Does the work indicate what the student was trying to say? Is the expressive concern of the student apparent in the visual statement?

_____ 5. SPACE: Does the work indicate attention to the artist's use of the entire space and are the visual forms organized in spatial relationships to one another?

_____ 6. SENSE OF DISCOVERY: Did the young artist make a discovery in the process of exploration and is that discovery suggested?

_____ 7. AESTHETIC SENSITIVITY: Does the work indicate perceptual awareness and sensitivity? Has the student been cognizant of what he has seen (lines, color, textures, shapes, movements), touched, heard, smelled?

_____ 8. EXECUTION AND CRAFTSMANSHIP: Does the art work indicate skill in handling media and processes that are appropriate for the expression?

_____ 9. SELECTIVITY: Does the artist evidence a straight-forward approach to the given problem, eliminating the superfluous?

_____ 10. ELEMENT DISTINCTION: Is there superior use of one or more of the visual elements - color, textural aspects, quality of line, positive and negative shapes, lights and darks (value contrast), composition, design elements, etc.?

Figure 1. Evaluative Instrument.

_____ 11. DETAIL: Does the artist use detail to support his solution to the problem?

_____ 12. DEPTH OF INVOLVEMENT: Does the art work indicate that the artist was involved, enjoyed the experience and probably has a good attitude toward art?

_____ 13. SELF-CONFIDENCE: Does the work indicate that the student was confident and unrestrained in approaching his art? This is shown in the deftness and sureness in handling the subject matter and media.

_____ 14. (DRAWING ONLY) MARK-MAKING: Is there an outstanding quality of mark-making in conjunction with subject and what the artist is trying to say?

_____ 15. EFFORT: Is there evidence of a high output of time and effort?

_____ 16. LEVEL OF ACHIEVEMENT: Is there evidence of an overall excellence of achievement?

Figure 1. (continued)

using the same procedures, lasted five hours.

These two sessions included debating personal judgment using the assessment criteria and then grouping the art work in categories. Initially, after information was shared about the teacher's assignment, the three evaluators judged each piece of art work independently using the assessment criteria in the Evaluation Instrument.

Each piece received three individual ratings, checking off the items exhibited in the work, using the assessment criteria #1-16 (Figure 1). The three evaluators then discussed the art work and placed the pieces in the following categories:

6

5

4

3

2

1

While the individual judgments of assessment varied there seemed to be some agreement about assigning art work to categories. For example, a piece of work with over 4 criteria satisfied was always rated an OUTSTANDING piece of work while works with one criteria satisfied were rated as CREATIVE.

Refined Instrument

In order to rate the number of works needed to make a valid

study and include three professional judgments the time required needed to be reconsidered. In addition, the investigator hoped to make this instrument available to classroom teachers who would need a less time consuming method.

The instrument needed to include characteristics that might distinguish a work of art and some quantification of the creative aspects of artistic achievement. From the work with initial evaluators, it was decided to use the 16 items in the original list of assessment criteria and to include a revised rating scale based on scores of 1-6. A standard scale was developed (see Figure 2) and enabled evaluators to score student art work:

6 Exceptionally creative

5 Highly creative

4 Creative

3 Competent solution - but not distinguished

2 Barely meets requirements - acceptable but deficient

1 Does not meet requirements - not acceptable

The inclusion of these more specific guidelines would allow evaluators to work independently. Therefore, the process could be more efficient and less time consuming. There no longer would be a need to have evaluators meet together.

Three evaluators, including the investigator, then applied this revised rating scale to a total of 549 works of student art work in kindergarten through sixth grade. The three evaluators were experienced and certified art teachers who were all three presently

REVISED RATING SCALE USED IN EVALUATION
OF STUDENT WORK

This scale was used in evaluation of art work and was an adaptation of Assessment Criteria (see Figure 1). "Distinguishing Characteristics" refer to Items 1-16 in Figure 1.

6 - FAR EXCEEDS REQUIREMENTS-EXCEPTIONALLY CREATIVE
Fulfills problem with 4-6+ distinguishing characteristics
Outstanding example of creative achievement

5 - EXCEEDS REQUIREMENTS-HIGHLY CREATIVE
Fulfills problem with 2-3 distinguishing characteristics
Superior example of creative achievement

4 - EXCEEDS REQUIREMENTS-CREATIVE
Fulfills problem with one distinguishing characteristic
Excellent example of creative achievement

3 - MEETS REQUIREMENTS-COMPETENT
Fulfills problem with no distinguishing characteristics
Capable but not distinguished example of creative achievement

2 - BARELY MEETS REQUIREMENTS-ACCEPTABLE BUT DEFICIENT
Approaches a solution of the problem with deficiency in one or more significant visual elements (e.g. use of color, composition, craftsmanship, communication of idea, etc.)
Acceptable but weak example of creative achievement

1 - DOES NOT MEET REQUIREMENTS-NOT ACCEPTABLE
Does not solve problem
Inadequate or poor example of creative achievement

Figure 2. Standard scale.

involved in teaching art. Their findings are discussed in Chapter IV.

Because a student entering kindergarten must be five years of age as of September 1, all children in this study were assumed to be the following ages:

Kindergarten	5-6
1st Grade	6-7
2nd Grade	7-8
3rd Grade	8-9
4th Grade	9-10
5th Grade	10-11
6th Grade	11-12

Time Period of Research

Observations

The investigation took place over a period of 15 months. During this time, the researcher participated in numerous classroom observations, read extensively in literature about creativity, brain growth and art and constructed the Evaluation Instrument. After the Evaluation Instrument was created, the three judges evaluated 549 pieces of children's art work.

Initially, the researcher spent several months observing art and classes of regular instruction at the primary subject school. In observation of art classes, data were collected on types of projects the teacher assigned, attention span of children of different ages,

the kinds of criteria the art teacher used in commenting on completed art work and in the instructional period. The investigator also noticed children's responses to the assignment, their ability to work independently, how influenced they were by how their peers were proceeding with the assignment. During this time, the researcher was attempting to observe how children of different ages approach creative problems and to observe developmental differences in children's art work described in the review of research Chapter II.

The investigator then interviewed art teachers asking for information, reflections and generalizations, if generalizations could be made, about working with children at particular ages. For example, teachers were asked to describe the main characteristics exhibited by first graders (second, third, etc.) as they worked on creative art projects. Art teachers were also asked to judge which grade was his/her favorite (and least favorite) in the art classroom.

The review of literature and related research and construction of the Evaluation Instrument were ongoing and when the Instrument was completed, three judges, including the investigator, met in several exploratory sessions of eleven hours to rate the initial 57 samples of art work.

Summer Art Classes for Young People

During the summer months, when schools were closed, the researcher compiled data already collected and continued the examination of literature and related research. She also observed children and teaching styles of instructors during a program, Summer Art Classes

for Young People, which the investigator coordinated at the local university art center.

The Young People's Art Class offered the researcher an opportunity to observe children of different ages (kindergarten through twelfth grade) as they worked with a variety of art materials and experiences and interacted with each other and with teachers. During this time, the investigator was involved in reflections on the creative process and she became aware of the importance of the element of discovery (see Figure 1.6) and the factor of motivation expressed as effort (see Figure 1.15) in the creative art work of children.

Testing of the Instrument

During this summer program, the researcher did some testing of the Evaluation Instrument, using art work from the summer program, and ratings, scored by three different judges, showed very little variation in range and suggested a promising degree of validity and reliability.

The investigator used the additional input from the summer program to revise and adapt the Evaluation Instrument. This Revised Instrument (Figure 2), described above, was then used by three judges who could now meet individually and score the art works. The three judges then scored the remaining 492 samples of children's art work in sessions lasting approximately 28 hours for each of them. Their findings are described in Chapter IV.

Need for Additional Data

The researcher was fortunate to have the opportunity to meet twice

with Herman T. Epstein during the course of this investigation. At the first meeting, Epstein reviewed the existing data, one group of works from each grade level, some of which were random samples and contained 11 or 12 pieces at a grade level. Epstein suggested that the number of pieces at each grade level be increased to 30 minimum. The three judges then scored the additional works so that each grade level had at least one group with 30 evaluated works.

At a subsequent meeting, Epstein again suggested that there were gaps in the data, and he suggested that the investigation would be stronger with additional scores for the first, second and third grades. The judges then evaluated additional work, so that there were data for the previously missing grades.

Epstein offered to examine the data and offered observations which are included in Chapter IV, The Presentation of Data.

Chapter IV presents the results of the research investigation and data.

Chapter IV

Presentation of Data, Conclusions, and Recommendations for Further Research

The data clearly led to the conclusions and recommendations which follow.

Presentation of Data

Three judges evaluated 549 samples of children's art work in kindergarten through sixth grade.

Each piece of work was rated individually by three judges, and each judge could assign the piece a score of 1-6 (See Figure 1.). A total or composite of the three judges' scores ranged from 3-18.

Since a score of 4 "exceeds requirements" and received a rating CREATIVE (See Figure 2.), a score of 12 or above (composite score of the three ratings) would be rated CREATIVE or HIGHLY CREATIVE, according to Figure 2. A composite score of below 12 was COMPETENT but not distinguished, ACCEPTABLE BUT DEFICIENT, or NOT ACCEPTABLE, according to Figure 2.

In kindergarten group K.1, ages 5-6, 21 (91.3%) of the samples were assigned a rating score of below 12, and 2 (8.7%) evaluated items received rating scores of 12 or above. In kindergarten K.2, there were 40 subjects, and 32 (80.0%) received a score of below 12 and 8 (20.0%) samples were assigned a score of 12 or above.(See Table 1)

Table 1

Summary of the Data Including Cumulative Percentages for Each Group

Grade	Age	N Subjects	N Scoring Below 12	N Scoring 12 & Above	Percent Not Creative	Percent Creative
K.1	5-6	23	21	2	91.3	8.7
K.2	5-6	40	32	8	80.0	20.0
1.1	6-7	37	14	23	37.8	62.2
1.2	6-7	13	6	7	46.2	53.8
2.1	7-8	20	5	15	25.0	75.0
2.2	7-8	35	13	22	37.1	62.9
3.1	8-9	36	4	32	11.1	88.9
3.2	8-9	18	6	12	33.3	66.7
4.1	9-10	57	51	6	89.5	10.5
4.2	9-10	134	92	42	68.7	31.3
5.1	10-11	31	14	17	45.2	54.8
5.2	10-11	21	8	13	38.1	61.9
6.1	11-12	21	6	15	28.6	71.4
6.2	11-12	35	18	17	51.4	48.6
6.3	11-12	28	14	14	50.0	50.0

Note. In the cases where there are two or more sections at the same grade level, the writer designated the first section K.1, second section K.2, etc.

In first grade group 1.1, ages 6-7, 14 (37.8%) works were assigned a score of 12 or below, and 23 (62.2%) received a rating of 12 or above. In the first grade group 1.2, 6 (46.2%) samples were assigned scores of below 12, and 7 (53.8%) evaluated items received rating scores of 12 or above.

In the second grade group 2.1, ages 7-8, 5 (25.0%) samples scored below 12, and 15 (75.0%) samples were assigned scores of 12 or above. In second grade group 2.2, 13 (37.1%) evaluated items were assigned scores below 12, and 22 (62.9%) scored 12 or above.

In third grade group 3.1, ages 8-9, 4 (11.1%) samples scored below 12, and 32 (88.9%) works achieved scores of 12 or above. In the third grade 3.2, 6 (33.3%) samples scored below 12, and 12 (66.7%) samples were assigned rating scores of 12 or above.

Fourth grade group 4.1, ages 9-10, had 51 (89.5%) samples scoring below 12, and 6 (10.5%) subjects achieved scores of 12 or above. In fourth grade group 4.2, 92 (68.7%) samples scored below 12, and 42 (31.3%) evaluated items achieved scores of 12 and above.

In fifth grade group 5.1, ages 10-11, 14 (45.2%) samples were assigned scores below 12, and 17 (54.8%) achieved scores of 12 and above. In fifth grade group 5.2, 8 (38.1%) samples scored below 12, and 13 (61.9%) achieved scores of 12 and above.

In sixth grade group 6.1, ages 11-12, 6 (28.6%) samples scored below 12, and 15 (71.4%) were rated 12 and above. There were 18 (51.4%) scoring below 12 in sixth grade group 6.2, and 17 (48.6) achieving scores of 12 and above. In sixth grade group 6.3, 14 (50.0%) samples

scored below 12, and 14 (50.0%) were rated 12 or above.

Table 1 explains graphically the number of children scoring below 12 (not creative) and those who scored 12 or above (creative or highly creative). It can be seen that these percentages correlate with the rapid brain growth periods and plateau periods described by Epstein.

The high percentage of children in kindergarten and fourth grade who received scores of below 12 (not creative) correlates with Epstein's period of slow brain growth or plateau periods. A graphic representation of the percentage of samples by group scoring 12 and above (creative) is shown in Figure 3.

In Figure 3, it can be seen that the percentage of creative scores in the two kindergarten and two fourth grade groups are significantly lower than the percentage of creative scores in the other grades. In fact, the highest percentage of creative scores in these four groups is 31.3% while the lowest percentage for the other groups is 48.6% and the highest is 88.9% creative.

Figure 3 illustrates graphically the lower creative productivity reflected in rating scores of children at ages which Epstein identifies as plateau stages. In contrast, Figure 3 shows the comparatively higher percentage of children exhibiting distinguished creative achievement in their art work in the grade levels which correlate with Epstein's rapid growth periods. Correspondingly, a graphic representation of the mean composite scores shows similar findings and correlates with Epstein.

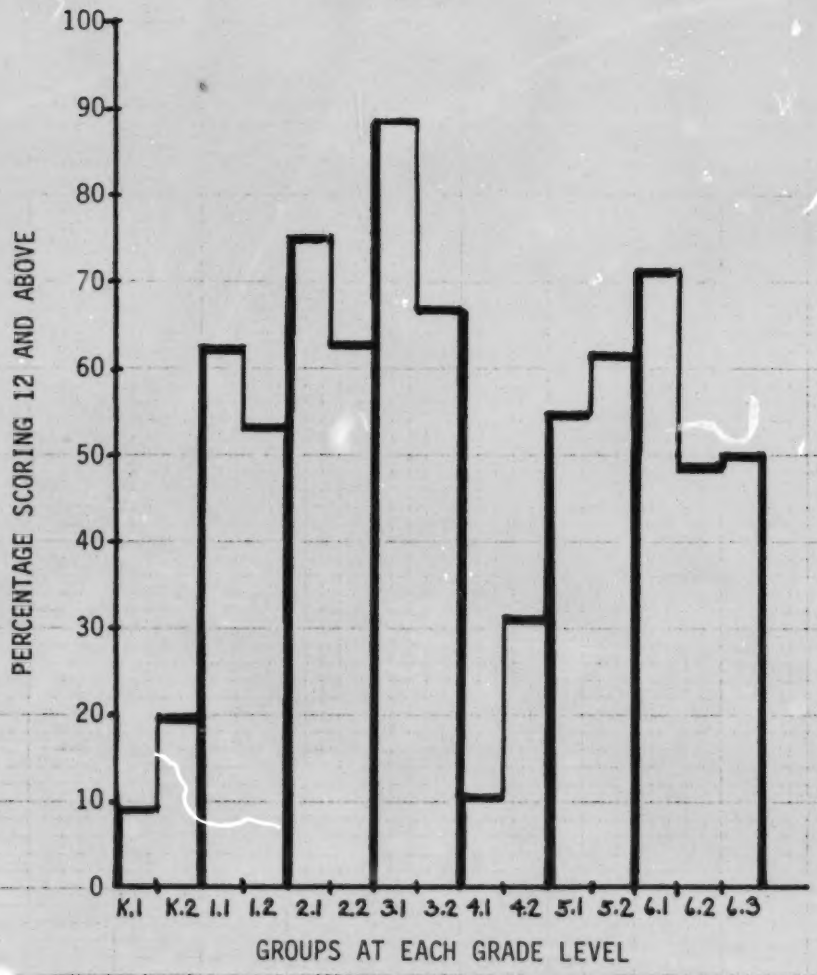

Figure 3. Percentage of samples scoring 12 and above (creative) in each group.

Note. Wide lines indicate grade levels and narrow lines represent groups within each grade.

The mean composite scores for each grade are as follows:

Table 2

Mean Composite Scores

Grade	N	Mean
K.1	23	8.9
K.2	40	9.8
1.1	37	12.1
1.2	13	11.8
2.1	20	13.3
2.2	35	12.5
3.1	36	14.4
3.2	18	12.8
4.1	57	8.1
4.2	134	9.9
5.1	31	11.2
5.2	21	13.2
6.1	21	13.2
6.2	35	11.5
6.3	28	11.1

These mean composite scores reveal higher achievement for children in brain growth stages, according to Epstein, and comparatively lower ratings for children in plateau periods. The mean composite scores are significantly lower in kindergarten (ages 5-6), and fourth grade (ages 9-10), both of which occur during a plateau period, according to Epstein's findings.

The histograms in Figure 4 graphically illustrate the findings that children in plateau periods did not produce the high level of creative output exhibited by children in rapid brain growth periods. Figure 4 describes the number of samples within each group and their

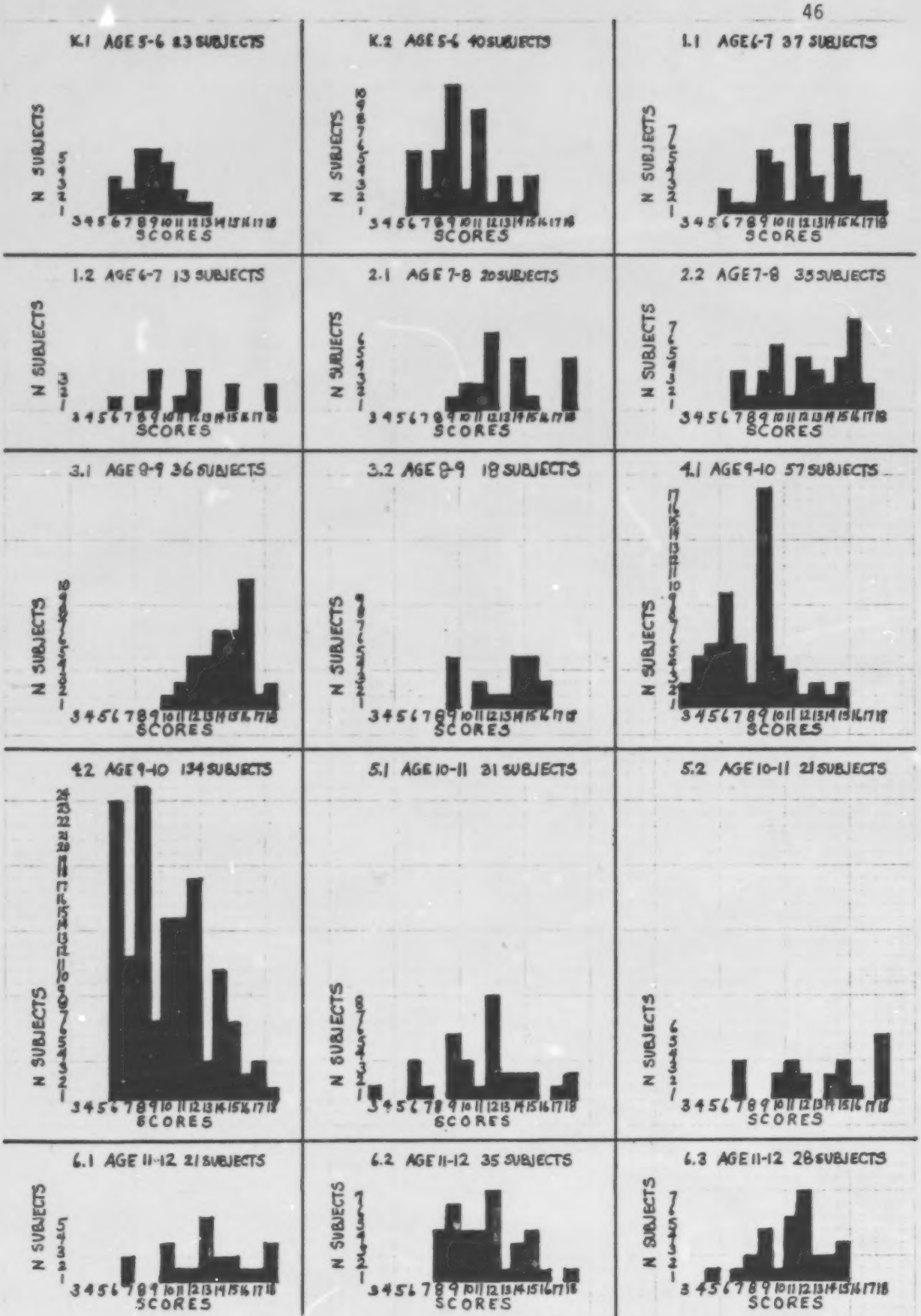
K.1 AGE 5-6 23 SUBJECTS
K.2 AGE 5-6 40 SUBJECTS
1.1 AGE 6-7 37 SUBJECTS
1.2 AGE 6-7 13 SUBJECTS
2.1 AGE 7-8 20 SUBJECTS
2.2 AGE 7-8 35 SUBJECTS
3.1 AGE 8-9 36 SUBJECTS
3.2 AGE 8-9 18 SUBJECTS
4.1 AGE 9-10 57 SUBJECTS
4.2 AGE 9-10 134 SUBJECTS
5.1 AGE 10-11 21 SUBJECTS
5.2 AGE 10-11 21 SUBJECTS
6.1 AGE 11-12 21 SUBJECTS
6.2 AGE 11-12 35 SUBJECTS
6.3 AGE 11-12 28 SUBJECTS
N SUBJECTS
SCORES

Figure 4. Histograms of rating scores within each group.

respective scores, assigned by the three judges using the Evaluation Instrument. It is possible to look at the histograms and see the clustering of scores and the formation of patterns of multiple peaks within a group.

As shown in Figure 4, there are larger numbers of children scoring below 12 (not creative) in kindergarten and fourth grade. These two age groups correspond to Epstein's plateau stages. In fact, the histograms for ages 9-10 years reveal a reversion to scores lower than 10.

Similarly, this decline in creative achievement in kindergarten and fourth grade is clearly indicated in Figure 5.

Figure 5 illustrates graphically the peaks and troughs in creative productivity revealed in the research data. As shown, there is a drop in creative output between ages 5 and 6 (kindergarten), and a rise in creative achievement between ages 6 and 8.

There is a large decrement in creative achievement scores between ages 9 and 10, and then an increment between ages 10 and 11. These peaks and troughs correlate with Epstein's rapid brain growth and plateau stages of development.

These tables and figures provide numerical and graphic descriptions of the rating scores to affirm that there is a strong connection between creative output and Epstein's research. Young artists exhibited a drop in creative productivity at kindergarten and fourth grade and significantly higher creative achievement during the stages described by Epstein as periods of rapid brain growth.

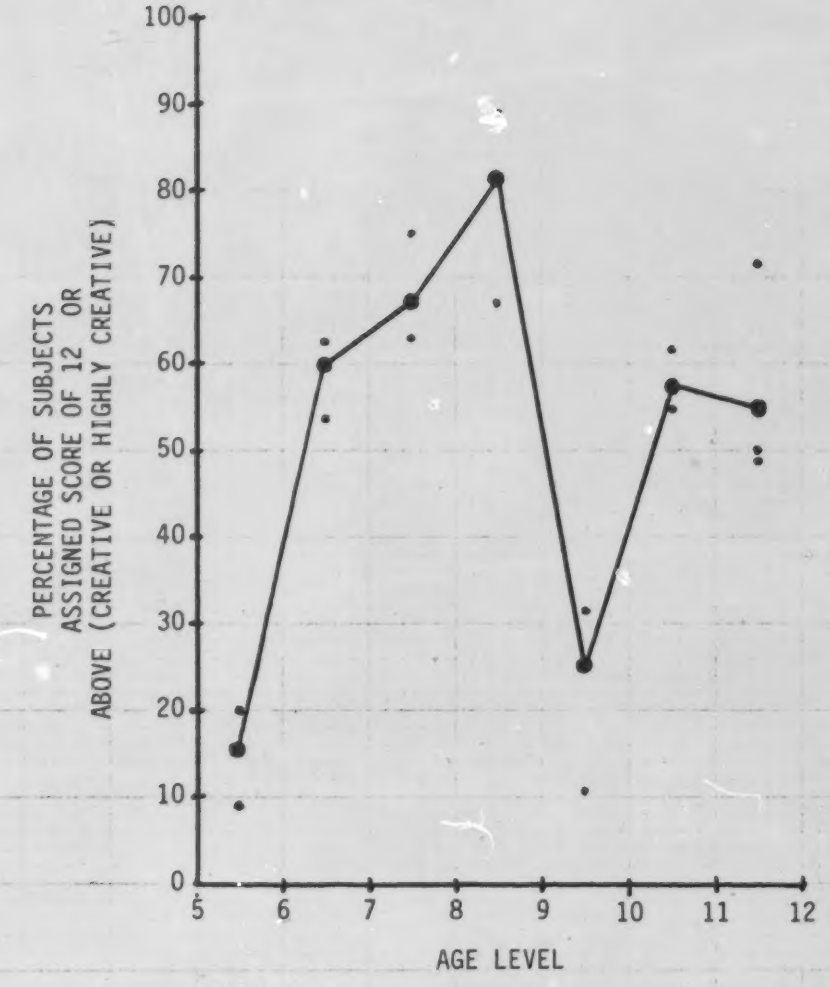

Figure 5. Peaks and troughs in creative productivity.

Note. The large points represent the average of the percent creative at each grade level. The smaller points indicate the percentage creative in each group

Conclusions

The null hypothesis was rejected.

The research indicated that there is a significant relationship between Epstein's brain growth stages and the creative art work of elementary school students.

In general, children in brain growth spurt periods received higher scores from three judges on creative art work than children in plateau periods.

The research disclosed that at a time when there is a growth in the complexity of neural networks there may be a corresponding increase in creative output according to evaluation scores. This research study has many implications for educators. The evaluations of 549 samples of creative art work suggested that a higher level of creative productivity might be occurring during the periods of rapid brain growth designated by Epstein. These findings suggest many possibilities for future research.

Recommendations for Further Research

1. There should be a replication of this study to verify the findings.

2. The Evaluation Instrument should be further tested for validity and reliability.

3. Research should be conducted comparing brain growth stages to other aspects of childhood learning.

4. There should be further research on the visual arts as a way to integrate other capabilities. Perhaps the visual arts and other

creative arts might be used as a way of understanding and expanding children's development of thought, language, and reading. For example, exposure to a variety of visual, tactile, and kinesthetic experiences in the arts may be related to and actually improve the child's ability to learn to reason, write, and read. Further investigation should be conducted to study how exploration in the arts and increased perceptual sensitivity may help the child to develop his competence in other subjects areas.

5. It is also suggested that there may be other connections between creativity in the visual arts and language development, or reading, or mathematics, etc. The investigator might utilize available research on those skills, the findings of this study, and Epstein's conclusions.

6. Sex related connections should be investigated at all age levels including differences in creative achievement between boys and girls and an examination of the possible connection with brain growth peaks and plateaus.

7. A particular examination of the hiatus in brain growth at age 12-14 and possible "turn-off" syndrome during the junior high school years should be further studied, along with investigation of possible sex differences and their impact. For this age group, an examination of the experiential learning opportunities, outside the school, recommended by Epstein also suggests many areas for further research.

8. There should be further study to determine whether periods of rapid brain growth are fertile for introduction of new and more

complex materials, and plateau or slow growth periods are more suitable for reinforcement and review.

9. Research should investigate the right-hemisphere and left-hemisphere connection with the visual arts and age-relatedness following Epstein's research findings.

10. There should be further observation and investigation of behavioral characteristics of children in rapid brain growth and plateau periods.

11. A study is recommended investigating "creative blocks" and the ways in which children and adults inhibit creative thinking, including a possible relationship with brain growth stages.

It is hoped that the suggestions provided here may prove useful as a beginning and stimulate further study. A whole range of new ideas emerged for continued exploration as a result of this study. This investigation stressed the importance of further research related to this study and the idea that such research does, in fact, lead to possible implications for schooling.

These educational implications are so important the researcher decided to devote a chapter to a discussion of the implications. How do we compose a creative environment for the developing child? Every dedicated educator strives to encourage invention and creative behavior. Chapter V deals directly with implications for educators which this research has suggested.

Chapter V

Implications for Education

It is the supreme art of the teacher to
awaken joy in creative expression and knowledge.

Albert Einstein

Implications

There are many indications of the existence of developmental stages of mental and creative growth. The following summary attempts to point out some general statements and implications for adapting school strategies and programs to include the facts from the research. Perhaps it can contribute to the improvement of educational practice.

Accessibility of the Research for Teachers, the Process of Changing Theory into Practice

One important idea suggested by this research (and emphasized by Epstein in two personal interviews) is the need to make new information and research findings readily accessible to educators. New knowledge is in itself a force for change, and in education it should provide the framework for eliminating teaching approaches which are not conducive to development. Much research is currently concerned with the introduction into curriculum of activities directed toward the development of thought (Schwebel and Raph, 1973).

Determining Cognitive Levels

de Meuron (Schwebel and Raph, 1973) emphasized the need to disseminate to educators new knowledge about how children think, the urgency of defining the particular level of thinking where a child is cognitively, and devising ways of interacting with tasks or activities appropriate to that level, and the need for re-education for teachers.

To reach the child where he is, we must find ways of quantitatively determining his cognitive level. We need a measure of the child's current development stage. What is of concern is the child's current learning capacity and learning style. According to H.T. Epstein, there are two investigators, Shayer and Arlin (Epstein, Note 1), who have succeeded in psychometrizing Piaget.

Shayer and Adey (Note 2) tested 2,000 children at every age from 10 through 14 years. There proved to be a wide distribution of children's cognitive levels at every age studied, and the implications were that age-grading for children does not reflect their styles of reasoning.

The brain growth stages appear in the data of this research. Children in the study went beyond level 2a, or the onset of concrete reasoning, only during the brain growth stages, and, similarly, most of the movement in the cognitive level 2b, or the mature concrete reasoning level, also occurs at the brain growth stages.

Cognitive Level Matching

Epstein (1979) emphasized a need for categorizing every child according to cognitive level. Then, educational strategies can be arranged "helping the child maximally by arranging instruction to be in the mode of cognition in which the child finds himself" (p. 4).

Epstein also described a need for devising testing of cognitive levels in different subject areas. Most of the people of the cognitive level (CL) tests are science-based. Epstein believes that there are significant differences of level in different subjects. Educators in the arts and language studies could work to develop CL tests in their particular disciplines.

Epstein and associates have devised a teacher sensitization course,

> [which] explains to teachers the origins of the concept of cognitive levels, shows the aspects being measured, then shows teachers how to sense or recognize the levels in the works, sentences, and ways of reasoning of the children. (Epstein, Note 3)

This course has been given three times and will be given twice more during this year.

Their approach to classroom instruction, structured in the form of teacher re-training workshops, involves Epstein's discovery of biological bases for Piaget's descriptions of how children's reasoning develops.

Experiential Inputs During Plateau Stages

Little cognitive level change seems to occur during brain growth plateaus. In order to help children grow cognitively, Epstein has recommended the creation of a proper combination of consolidation inputs [of reasoning abilities] plus experiential learning during plateau periods.

During plateau periods, he advocates a series of well-designed first-hand confrontations with nature and the environments of cities and towns (age 4-6), work experience, organizations of society such as monuments and special buildings (ages 8-10) and direct work experience, not in the schools themselves, for students 12-14 years.

If students' achievements during brain growth periods do indeed have characteristics of a higher level of creativity, the implications for education are tremendous. Periods of brain growth could be flexible for introduction of new and more complex materials, and plateau or non-growth periods would be more suitable for reinforcement, review, and experiential learning.

Blocks to Creativity

In a drawing experiment with 170 adults of various ages and professions Lark-Horovitz (1936) found that drawings by adults compare mainly with those made by children between the ages of 6 and 10. Lark-Horovitz and Norton (1959) cited this study.

Perhaps like the blocks which are built in junior high school years when information is presented which children in plateau periods cannot handle, adults and children develop blocks to creativity.

When too challenging material is presented during a plateau period or when criticism is offered at an inappropriate moment, creativity is blocked, and perhaps this block remains even as the individual otherwise develops.

Substages in Creative Development

There may be substages in levels of creative development. General developmental characteristics of children's art work have been described by Kellogg, Lansing, Lindstrom, et. al. Epstein and his associates believe there may be peaks and troughs connected with the brain growth and plateau periods which could be tested and observed in a series of well-designed visual projects. This area is rich in material for future research.

Sex Differences

Another area of concern cited by Epstein was sex differences. The raw numbers indicated a math/science slow-up of development of females. There are indications of differences in brain growth between the sexes. During the 10-12 year period girls experience three times as much brain growth as boys. The situation is reversed for the growth spurt centered around age 15 years. (Epstein, 1978) The whole subject of sex differences in mental and creative development will have to be studied.

The Arts as Integrator

The arts might provide a way to integrate other capabilities. Visual thinking or creative investigation expressed in visual terms might be related to cognitive levels. Using the creative arts as a

way of understanding and expanding children's development of thought, language and reading might offer many subjects for future research.

The arts and perceptual involvement. Everyone looks, but only a few individuals learn to see. Through the arts, students develop an openness, a receptivity to sensory input. Piaget pointed out the difference between perception and perceptual involvement. In the creative arts, students experience intense perceptual involvement and have the opportunity to actively express their responses through media.

A sensitization process that begins with simple perceptual exercises and gradually becomes more sophisticated would help students become more ACTIVE LEARNERS and feed into the process of cognitive development. Children need many more "hands-on" experiences in the arts, but, also these enriched creative projects will provide opportunities for children to grow as appreciators of the arts. In a society as advanced and varied as ours, we need to nourish and nurture the future creative genuises, the artists of all disciplines, but also we need to create an educated audience for the arts.

The Arts and Personal Discovery

The researcher referred to the importance of discovery in the creative process and in the education of children. The arts provide unique opportunities for personal discovery and exploration.

Through the arts children may vividly exhibit the processes of their thought, and they may experience the creative and thinking

processes of other minds.

The process of thinking of the painter and the printmaker may be seen in the marks and shapes of the finished product, the work of art. For the child, the art product is a fringe benefit of a process of discovery, creative thinking, and exploration. Too often, in art education, the product becomes all-important, and the process or experience, much more significant to the child's personal growth and development, is secondary.

As educators, we need to begin to use new input and to stress creative and appropriate cognitive development. The teaching-learning process must begin to focus on teaching children how to think and on designing creative problem-solving techniques appropriate to the child's cognitive level. Reaching the child where he is must begin to be a standard and providing him with an environment rich in experiences and opportunities to move on from where he is and to begin to explore his own creative abilities must become our primary goal.

The Arts and Cognitive Growth

Art projects are particularly suited to giving the child both a number of choices and instruction in how to make choices, so essential to the developing cognitive processes. The arts provide children with rich opportunities in learning how to consider options and make choices.

It might prove especially significant to expose children to the arts particularly during brain growth plateau periods. Eleanor

Duckworth (Schwebel and Raph, 1973) emphasized:

> Painting, pantomime, model-building, mathematical symbols -- to the extent that these have at least some aspect of recreating, reconstructing, or representing something other than what they themselves are -- represent, for the person who creates them, something of his understanding. . . . What they evoke in the beholder is the same understanding or knowledge or feeling as that which the producer had in mind. They call upon the beholder to make his own connections, in order for the representation to make sense to him. (p. 147-148)

Active Learning

The need for experiential learning and direct experiences with media are emphasized repeatedly in research about education. Experiential arts courses such as the one the researcher is presently teaching provide opportunities for student creative and cognitive growth. More interdisciplinary "hands-on," appreciation through creation courses in the creative arts need to be included in the education of young minds.

Perhaps, there is also a need to restructure creative education. Teachers and children need to be re-trained in how to think and how to open the channels for the expression of this creative thinking in all the disciplines in schooling.

Manipulation of Materials and Cognitive Growth

The arts also provide children with many opportunities to manipulate materials and re-structure their environment adding to the child's internal construction of reality, so important in the cognitive development described by Piaget. The child may invent,

construct, create, manipulate, represent, and cognize through the arts.

In art there is no right or wrong. There is ONLY search, explore, discover, do, and MAKE.

Readiness

Concerning the idea of readiness this research paper and, particularly, Epstein's findings suggested some important implications. Perhaps readiness has a biological basis and cannot be taught. Perhaps readiness must be DISCOVERED like one discovers a work of art that is good. If readiness is connected with brain growth, then readiness for new functions in some children may be late. If brain growth is late in the age spans tested then the child is not necessarily a dull child; he just develops the new brain networks later. Epstein (1980) indicated: "Accelerated body development, by itself, need not be taken as a sign that the lack of associated mental growth acceleration is serious" (p. 48). The ramifications of these ideas about readiness for Head Start, kindergarten, and other pre-school programs present many possibilities for future research.

Another possible way to use the contents of the study is for the classroom teacher to employ the revised rating scale as an instrument for student self-evaluation. A student may apply the rating scale to his own work and thereby become more sensitive to the pursuit of quality and the significance of the elements of art in evaluating a creative product. For younger school children, the verbal description needs simplification.

When appropriate, instructors may also use the revised rating scales in assessing student work. Perhaps the instrument may be utilized also by teachers who are not art specialists. The investigator suggests that the evaluative criteria be used however educators conceive that it might contribute to artistic competence and encourage children's growth in the arts.

Too Much Too Fast Too Soon

Epstein expressed personal concern that this information and brain growth research must be used with caution. Programs should not be revised and curricula should not be revamped. Improvements in the teaching-learning process must precede any attempts to revise school curricula. Small changes may be made, but new experiments and verification of already existing data are necessary before major changes or growth ought to take place.

The combination of new input, a greater emphasis in education on the creative arts, and the possibilities for cognitive growth that children might experience in their interaction with the arts may prove very promising for all those involved in the teaching-learning process.

Reference Notes

1. Epstein, Herman T. The problem of the match revisited: cognitive level matching. Manuscript submitted for publication, 1981.
2. Epstein, Herman T. The problem of the match revisited: cognitive level matching.
3. Epstein, Herman T. The problem of the match revisited: cognitive level matching.

Bibliography

Anatasi, Anne. Psychological testing (3rd ed.). New York: MacMillan, 1968.

Anderson, Harold H. (Ed.). Creativity and its cultivation. New York: Harper and Brothers, 1959.

Ansara, Alice, & Rawson, Margaret B., (Eds.). Bulletin of the Orton Society: An interdisciplinary journal of specific language disability (Vol. XXX). Towson, Maryland: The Orton Society, 1980.

Bronowski, J. The ascent of man. Boston: Little, Brown and Company, 1973.

Canfield, Jack, & Wells, Harold C. 100 ways to enhance self-concept in the classroom. Englewood Clifts, New Jersey: Prentice-Hall, 1976.

Chaet, Bernard. The art of drawing. New York: Holt, Rinehart and Winston, 1970.

Cohen, Elaine Pear, & Gainer, Ruth Strauss. Art: another language for learning. New York: Citation Press, 1976.

Coopersmith, Stanley (Ed.). Frontiers of psychological research. (Readings from Scientific American). San Francisco: W.H. Freeman, 1966.

Cronbach, Lee J. Essentials of Psychological Testing (3rd ed.). New York: Harper & Row, 1970.

Dasen, Pierre R. Cross-cultural Piagetian research: a summary. Journal of Cross-Cultural Psychology. March 1972, 3 (10), 23-29.

Edwards, Betty. Drawing on the right side of the brain. Los Angeles: J.P. Tarcher, 1979.

Eichenwald, Heinz F., M.D. The prevention of mental retardation through control of infectious diseases. Washington, D.C.: U.S. Government Printing Office, 1966.

Epstein, Herman R. Phrenoblysis: special brain and mind growth periods. I. Human brain and skull development. Developmental Psychobiology, 1974, 7, 206-216. II. Human mental development. Developmental Psychobiology, 1974, 7, 217-224.

Epstein, Herman T., & Epstein, Erika B. The relationship between brain weight and head circumference from birth to age 18 years. American Journal Phys. Anthropology, 1978, 48, 471-474. (a)

Epstein, Herman T. Some additional data relevant to considerations about the existence of cognitive-developmental stages. The Behavioral and Brain Sciences, 1978, 2, 185. (b)

Epstein, Herman T. Brain growth and cognitive functioning. Colorado Journal of Educational Research, 1979, 19, 3-4.

Epstein, Herman T. Some Biological Bases of Cognitive Development, Bulletin of the Orton Society, 1980, 30, 46-62.

Feldman, Edmund Burke. Becoming human through art aesthestic experiments in the school. Englewood Cliffs, New Jersey: Prentice-Hall, 1970.

Furth, Hans G. Piaget and Knowledge: theoretical foundations. Englewood Cliffs, New Jersey: Prentice-Hall, 1969.

Garrett, Susan V. Putting our whole brain to use: a fresh look at the creative process. The Journal of Creative Behavior, 1975, 10 (4), 239-249.

Getzels, Jacob W., & Jackson, Philip W. Creativity and intelligence. New York: John Wiley & Sons, 1962.

Gittner, Lena L. Montessori's legacy to children. Indiana, Pennsylvania: Shick, 1970.

Gorman, Richard M. Discovering Piaget, a guide for teachers. Columbus, Ohio: Merrill, 1972.

Guildford, J.P. Way beyond the IQ: guide to improving intelligence and creativity. Buffalo, New York: Creative Education Foundation, 1977.

Hahn, Martin E., Jensen, Craig, & Dudek, Bruce C. (Eds.). Development and evolution of brain size: behavioral implications. New York: Academic Press, 1979.

Hardeman, Mildred (Ed.). Children's Ways of Knowing: Nathan Isaacs on education, psychology, and Piaget. New York: Teachers College Press at Columbia University, 1974.

Hardiman, George W., & Zernich, Theodore. Art activities for children. Englewood Cliffs, New Jersey: Prentice-Hall, 1981.

Ingvar, David H. Functional landscapes of the dominant hemisphere. Brain Research, 1976, 107, 181-197.

Kellogg, Rhonda, Analyzing children's art. Palo Alto, California: Mayfield, 1970.

Lansing, Kenneth M., The research of Jean Piaget and its implications for art education in the elementary school. Studies in Art Education, 1966, 7 (2), 33-42.

Lansing, Kenneth M. Art, artists, and art education. Dubuque, Iowa: Kendall/Hunt, 1976.

Lark-Horovitz, Betty, & Norton, James. Children's art abilities: developmental trends of art characteristics. Child Development, 1959, 30, 433-452.

Lindstrom, Miriam. Children's art. Berkeley: University of California Press, 1957.

Logan, Lillian M., & Logan, Virgil G. Design for Creative teaching. Toronto, Canada: McGraw-Hill of Canada, 1971.

Lowenfeld, Viktor, & Brittain, W. Lambert. Creative and mental growth (5th ed.). London: Collier-MacMillan Limited, 1970.

McNally, D.W. Piaget, education and teaching. Lewes, Sussex, England: New Educational Press, 1974.

Michelson, Maureen. The right way of drawing out the artist in you. State of the Arts, February, 1981.

Pryor, Karen W., Haag, Richard, & O'Reilly, Joseph. The creative porpoise: training for novel behavior. Journal of the Experimental Analysis of Behavior, July, 1969, 12 (4), 653-661.

Restak, Richard M. The soul of a peacock. The brain: the last frontier. New York: Doubleday, 1979.

Schwebel, Milton, & Raph, Jane. Piaget in the classroom. New York: Basic Books, 1973.

Singer, June. A synthesis of contradictions: creativity in the analytical psychology of C.G. Jung. Perspectives on creativity and the unconscious. Edited by Donald W. Fritz, Oxford, Ohio: The Old Northwest, 1980.

Snow, Aida Cannarsa. Growing with children through art. New York: Reinhold Book Corporation, 1968.

Stallings, Jane A. Learning to Look, A Handbook on Classroom Observation and Teaching Methods. Belmont, California: Wadsworth, 1977.

Stein, Morris I. Stimulating Creativity (2 vols.). New York: Academic Press, 1974-75.

Sund, Robert B. Piaget for educators. Columbus, Ohio: Merrill, 1976.

Torrance, E. Paul. Guiding Creative Talent. Englewood Cliffs, New Jersey: Prentice-Hall, 1962.

Torrance, E. Paul. Rewarding Creative Behavior. Englewood Cliffs, New Jersey: Prentice-Hall, 1965.

Torrance, E. Paul. Understanding the fourth grade slump in creative thinking, Final USOE Report, Cooperative Research Project 994-5-0508-1-12-1. Athens, Georgia: Georgia Studies of Creative Behavior, 1967.

Torrance, E. Paul. Examples and rationales of test tasks for assessing creative abilities. The Journal of Creative Behavior, Summer 1968, 2 (3), 165-178.

Torrance, E. Paul. Creative ways of teaching. New York: Jeffrey Norton, 1969. (Cassette) (a)

Torrance, E. Paul. Involvement: learning in creativity and problem solving. New York: Jeffrey Norton, 1969. (Cassette) (b)

Torrance, E. Paul. Working with creatively gifted children. New York: Jeffrey Norton, 1969. (Cassette) (c)

Torrance, E. Paul, & Myers, R.E. Creative learning and teaching. New York: Dodd, Mead & Company, 1970.

Trachtman, Leon E. Creative people, creative times. Journal of Creative Behavior, 1975, 9 (1), 38.

Warnock, Peter. Creativity -- that underemployed skill. Lifelong Learning: The Adult Years, 1979, 3, 4-6.

Appendix

Table 3

Scores of Children Assigned by Three Judges Using Evaluation Instrument

Grade Level:	Problem:	Media:
K.1	Finding Pattern in Your Own Environment: Study of Child's House	Collage, Markers, Paint, Crayons

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
1. Kelly N.	4	3	2	9
2. Amber C.	2	2	2	6
3. David B.	2	2	2	6
4. Stephen N.	2	2	2	6
5. Kelly W.	2	3	2	7
6. Travis G.	2	3	2	7
7. Martha C.	2	3	3	8
8. Todd S.	2	3	3	8
9. Jeff F.	4	3	3	10
10. Lee Ann W.	4	3	3	10
11. Angela K.	3	4	3	10
12. Bobby B.	3	3	3	9
13. Cameron R.	2	3	3	8
14. Karen F.	2	3	3	8
15. Jason F.	3	3	3	9
16. Lars T.	3	3	3	9
17. Matt M.	2	3	3	8
18. Brad R.	2	4	4	10
19. Tammy C.	3	4	4	11
20. Douglas S.	4	5	4	13
21. Nathan L.	3	4	4	11
22. Sara L.	3	4	4	11
23. Carin A.	3	3	3	9

Table 4

Scores of Children Assigned by Three Judges Using Evaluation Instrument

Grade Level: K.2 | Problem: How to Develop a Pattern: Design Study | Media: Oil Pastel, Crayons, Markers

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
1. Douglas S.	5	5	5	15
2. Carin A.	5	5	5	15
3. Michelle C.	3	5	5	13
4. Martha F.	5	5	5	15
5. Lee Ann W.	3	5	5	13
6. Sara G.	4	5	5	14
7. Mitali S.	2	3	4	9
8. Karen F.	3	4	4	11
9. Jeff F.	3	4	4	11
10. Kim K.	3	4	4	11
11. Jennifer F.	3	4	4	11
12. Jason H.	3	4	4	11
13. Martha C.	3	4	4	11
14. Tammy C.	3	4	4	11
15. Brad R.	5	4	3	12
16. Angie J.	3	3	3	9
17. Kerri E.	3	3	3	9
18. Nathan L.	5	3	3	11
19. Brad W.	2	3	3	8
20. Chris B.	2	3	3	8
21. Angela K.	2	3	3	8
22. Todd S.	2	3	3	8
23. Belinda H.	4	3	3	10
24. Mike B.	4	3	3	10
25. Jason F.	3	3	3	9
26. Lars T.	3	3	3	9
27. Amber C.	2	3	3	8
28. Cameron R.	3	3	3	9
29. Brendan C.	5	5	3	13
30 Travis G.	3	3	3	9
31. David B.	3	3	3	9
32. Stephen N.	3	3	3	9
33. James H.	3	3	3	9
34. Jeff L.	3	2	2	7
35. Karen E.	2	2	2	6
36. Ryan L.	3	2	2	7

Table 4 (continued)

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
37. Kendra H.	2	2	2	6
38. Michaela R.	2	2	2	6
39. Kelly W.	2	2	2	6
40. Acey R.	2	2	2	6

Note. To increase the child's visual vocabulary was one of the main objectives of this 8 section study using repeating patterns of lines, shapes and colors.

Table 5

Scores of Children Assigned by Three Judges Using Evaluation Instrument

Grade Level:	Problem:	Media:
1.1	Cylinder People: Construct a Figure Whose Clothing Indicates His Occupation or Identity	Cardboard Tubes, Construction Paper, Markers

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
1. Sara G.	5	5	5	15
2. Brad R.	4	4	5	13
3. Kelly W.	5	6	5	16
4. Lars T.	4	4	4	12
5. Ryan L.	2	2	2	6
6. Belinda H.	3	4	4	11
7. Todd S.	4	5	5	14
8. Paula M.	4	4	4	12
9. Matt M.	5	6	6	17
10. Travis G.	3	4	2	9
11. David B.	3	4	3	10
12. Randy H.	3	3	2	8
13. Kendra H.	5	6	5	16
14. Nathan L.	4	4	5	13
15. Tammy C.	5	5	5	15
16. Micaela R.	2	2	2	6
17. Douglas S.	5	5	6	16
18. Lee Ann W.	6	6	6	18
19. Amber C.	3	3	3	9
20. Angela K.	5	5	5	15
21. Karla K.	5	5	5	15
22. Bobby B.	4	3	3	10
23. Martha C.	4	4	4	12
24. Karen F.	5	5	5	15
25. Angie J.	3	3	3	9
26. Cameron R.	2	2	3	7
27. Carin A.	4	4	4	12
28. Tim C.	3	3	3	9
29. Nathan L.	5	5	5	15
30. Lea Anne R.	4	5	4	13
31. Jason M.	4	4	4	12
32. Mitali S.	3	3	3	9
33. Chris B.	3	4	3	10
34. Kelly W.	4	4	4	12

Table 5 (continued)

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
35. Nicole C.	4	4	4	12
36. Angel K.	4	3	3	10
37. Jennifer F.	5	5	5	15

Note. To give students the experience of a sculptured study at a rather early age was part of the motivation for this lesson. Also, this problem involved further study of a theme, previously introduced, further exploration of the child himself and his perception of individuality in others.

Table 6

Scores of Children Assigned by Three Judges Using Evaluation Instrument

Grade Level: 1.2

Problem: Spring Flowers

Media: Collage with colored construction paper and markers

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
1. Nicole P.	5	5	5	15
2. Clay V.	5	5	5	15
3. Peter N.	6	6	6	18
4. Deanna M.	2	3	3	8
5. Angie Jo S.	3	3	3	9
6. Jodi G.	3	3	3	9
7. Kelly L.	2	2	2	6
8. Darrell C.	4	4	4	12
9. Angie M.	6	6	6	18
10. Tanya C.	4	4	3	11
11. Steve Charles M.	4	4	4	12
12. Misty Jean	4	4	4	12
13. Brent C.	3	3	3	9

Table 7

Scores of Children Assigned by Three Judges Using Evaluation Instrument

Grade Level:	Problem:	Media:
2.1	Weaving: Color Discrimination, Texture and Pattern Study	Colored Yarns of Various Textures

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
1. Michael G.	4	5	5	14
2. Matt K.	4	3	3	10
3. Jodie G.	6	6	6	18
4. Darrell K.	5	4	5	14
5. Carol W.	6	6	6	18
6. Margaret E.	4	4	4	12
7. David S.	3	4	3	10
8. Ryan W.	5	4	5	14
9. Clay V.	6	6	6	18
10. Jennifer H.	3	4	4	11
11. Nicole P.	6	6	6	18
12. Tonya C.	3	5	4	12
13. Heather H.	4	5	5	14
14. Aimee C.	3	4	4	11
15. Tom R.	4	4	4	12
16. Jason C.	2	4	3	9
17. Patrick E.	4	5	3	12
18. James P.	4	4	4	12
19. Angela M.	4	4	4	12
20. Angela T.	5	5	5	15

Note. Introduction of a new technique. Learning a new skill constituted part of the problem.

Table 8

Scores of Children Assigned by Three Judges Using Evaluation Instrument

Grade Level: 2.2 | Problem: Study of Spring Flowers | Media: Watercolor

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
1. Lori D.	6	5	6	17
2. Darrell C.	5	5	6	16
3. Scott R.	6	5	5	16
4. Steve M.	3	4	3	10
5. Michael G.	6	5	6	17
6. Margaret E.	5	6	5	16
7. James D.	5	5	5	15
8. Aimee C.	4	4	5	13
9. Angie H.	6	4	6	16
10. Carrie P.	3	4	3	10
11. Kelly L.	5	5	5	15
12. Angie N.	3	3	3	9
13. Tom P.	4	4	4	12
14. Patrick E.	6	5	5	16
15. Loretta B.	3	2	3	8
16. Jodie G.	4	4	4	12
17. Angela T.	4	3	3	10
18. Jonathan W.	5	3	6	14
19. Heather H.	2	3	2	7
20. Clay V.	3	4	2	9
21. Ryan W.	3	4	4	11
22. Angela H.	5	5	3	13
23. David S.	3	4	3	10
24. Crystal S.	3	3	3	9
25. Robbie S.	6	3	6	15
26. Misty G.	2	3	2	7
27. Nicole P.	5	5	6	16
28. Brent C.	4	4	4	12
29. Deanna M.	4	4	4	12
30. Mike S.	6	5	5	16
31. Tanya C.	1	4	2	7
32. Jason C.	3	4	3	10
33. Matt K.	5	5	5	15
34. Angie F.	5	5	4	14
35. Steven G.	5	4	4	13

Table 9

Scores of Children Assigned by Three Judges Using Evaluation Instrument

Grade Level:	Problem:	Media:
3.1	Sculpture: 3 Dimensional Study Using Color	Paper-mache, Cylinders Tempera, Varnish

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
1. Charlene W.	5	5	6	16
2. Steve M.	6	5	5	16
3. Kim I.	6	4	6	16
4. Jason L.	5	5	4	14
5. Julie V.	5	4	5	14
6. Yvonne L.	6	6	6	18
7. Rhonda H.	5	5	6	16
8. J.B. B.	4	3	3	10
9. Scott L.	5	4	5	14
10. Shannon W.	4	4	4	12
11. Matt A.	4	3	4	11
12. Kim A.	4	4	4	12
13. Debbie C.	6	5	5	16
14. Joe T.	6	5	5	16
15. Paige P.	4	4	4	12
16. Susan D.	5	6	5	16
17. Stacy T.	6	5	6	17
18. Mia G.	5	4	4	13
19. Clint S.	5	4	5	14
20. Chana S.	5	5	5	15
21. Brett H.	5	5	6	16
22. Ryan S.	6	6	6	18
23. Jamie R.	4	4	5	13
24. Melissa L.	5	5	5	15
25. Jerrod K.	5	5	5	15
26. Chris M.	4	5	5	14
27. Jamie A.	5	4	4	13
28. Kim S.	5	5	5	15
29. Shannon B.	5	5	4	14
30. Hydie A.	5	5	5	15
31. Chris C.	4	4	5	13
32. Bobby M.	5	5	6	16
33. Troy P.	4	3	4	11
34. Adam P.	4	4	4	12
35. David S.	5	4	6	15
36. Randy P.	5	5	6	16

Table 10

Scores of Children Assigned by Three Judges Using Evaluation Instrument

Grade Level:	Problem:	Media:
3.2	Self-Portrait: Trying to Portray Child's Personality and Inner Feelings	Chalk, Tempera, Ink, Water, Construction Paper

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
1. Jennifer N.	5	5	5	15
2. Katherine E.	5	6	5	16
3. Kim C.	4	4	4	12
4. Kim S.	3	3	3	9
5. Brad G.	3	3	3	9
6. Ann P.	4	4	3	11
7. Jason B.	3	3	3	9
8. Sam D.	4	4	3	11
9. Vangie W.	3	3	3	9
10. Stephanie C.	4	5	5	14
11. Susan W.	6	4	5	15
12. Lonnie P.	4	5	5	14
13. Kim C.	5	5	5	15
14. Paul S.	4	4	5	13
15. Michele M.	4	5	5	14
16. Heidi R.	5	6	5	16
17. Tim H.	5	5	5	15
18. Brad W.	4	5	5	14

Note. Introduction of new technique, tempera wash-out, was one of the objectives of this problem.

Table 11

Scores of Children Assigned by Three Judges Using Evaluation Instrument

Grade Level:	Problem:	Media:
4.1	Landscape Study Using Color, Texture and Detail to Indicate Depth	Tempera and Ink

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
1. Ray R.	2	2	2	6
2. Debbie L.	2	2	2	6
3. Claudette L.	3	3	3	9
4. Steve L.	3	3	3	9
5. Gina S.	5	5	5	15
6. Mollie McA.	3	3	3	9
7. Shelly L.	3	3	3	9
8. Rick M.	3	3	4	10
9. Mike A.	5	5	5	15
10. Shelia B.	3	3	4	10
11. Sherri I.	3	3	3	9
12. Shannon P.	3	3	4	10
13. Steve C.	3	3	3	9
14. Lloyd P.	2	2	2	6
15. Missy C.	3	3	3	9
16. Chris H.	2	2	2	6
17. Kyle F.	3	3	3	9
18. Mike N.	4	4	4	12
19. Billy B.	3	3	3	9
20. Cindy P.	3	2	2	7
21. Joyce H.	2	2	2	6
22. Tracy P.	2	3	2	7
23. Kristie W.	2	2	2	6
24. Michelle K.	3	3	3	9
25. Jennifer M.	3	3	3	9
26. Stacy I.	4	4	5	13
27. Tammy N.	3	3	3	9
28. Paul D.	4	5	4	13
29. Vicky P.	5	4	5	14
30. Larry K.	3	2	2	7
31. Melissa C.	3	4	3	10
32. Mark F.	1	1	2	4
33. Doug C.	1	1	1	3
34. Mark F.	1	2	1	4
35. Keith R.	1	2	2	5
36. Tim B.	1	2	1	4
37. Scott B.	1	2	2	5
38. Bill L.	1	2	2	5

Table 11 (continued)

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
39. Beth C.	1	1	1	3
40. Kristy M.	1	2	2	5
41. Christa S.	1	2	2	5
42. Michelle W.	2	3	3	8
43. Heather K.	2	2	2	6
44. Chad R.	2	2	2	6
45. Troy P.	2	2	2	6
46. Angi S.	2	1	1	4
47. Paul P.	2	2	3	7
48. Carrie N.	3	3	3	9
49. Jill G.	3	3	2	8
50. Tracy S.	3	4	4	11
51. Dan H.	3	3	3	9
52. Lisa T.	3	3	3	9
53. Lisa S.	3	3	3	9
54. Ken F.	3	2	2	7
55. Cindy M	3	4	4	11
56. Susan G.	3	3	3	9
57. Scott N.	3	4	4	11

Table 12

Scores of Children Assigned by Three Judges Using Evaluation Instrument

Grade Level:	Problem:	Media:
4.2	Paper Bag Decoration with Christmas Spirit Theme	Oil Pastel

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
1. Kathy W.	4	4	3	11
2. Kimberly S.	4	4	4	12
3. Jim E.	3	3	2	8
4. Andi T.	3	3	2	8
5. Cary G.	3	3	2	8
6. Missie S.	3	4	2	9
7. Becky B.	3	3	4	10
8. Michelle W.	3	4	4	11
9. Stephanie C.	3	4	3	10
10. Mike C.	3	4	3	10
11. John W.	3	4	3	10
12. Darrell K.	3	4	3	10
13. Jeff W.	3	4	3	10
14. Anita C.	3	4	3	10
15. David S.	3	2	3	8
16. Lynn T.	3	3	2	8
17. Jason B.	3	3	2	8
18. Billy C.	3	3	2	8
19. Tracy G.	3	3	2	8
20. Troy K.	3	3	2	8
21. Sara M.	3	3	2	8
22. Julie L.	3	3	3	9
23. Susan W.	3	2	3	8
24. Mike T.	3	3	4	10
25. Chris B.	3	4	3	10
26. Paul S.	3	2	3	8
27. Darby K.	3	3	2	8
28. Seth C.	3	4	3	10
29. Arthur B.	3	3	3	9
30. Candy E.	3	4	3	10
31. David B.	3	4	3	10
32. Becky P.	3	3	3	9
33. Teresa M.	3	3	2	8
34. Jeff S.	3	3	2	8
35. Sherry V.	3	3	2	8
36. Tim T.	3	2	2	7
37. Rona C.	3	2	2	7

Table 12 (continued)

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
38. Bradley G.	3	3	2	8
39. Stacy P.	3	4	5	12
40. John M.	3	3	2	8
41. Bryan M.	3	3	2	8
42. Bernadette C.	3	3	2	8
43. Crystal B.	3	2	2	7
44. Jennifer MacG.	3	3	2	8
45. Ronald S.	3	2	2	7
46. Kimberly P.	3	3	2	8
47. Jamey C.	2	2	2	6
48. Liz N.	2	2	2	6
49. Kimberly D.	2	3	2	7
50. Kathy H.	2	3	2	7
51. Traci W.	2	2	2	6
52. Brad W.	2	3	2	7
53. Eric T.	2	2	2	6
54. Joey O.	2	2	2	6
55. Kathy B.	6	5	3	14
56. Stephanie C.	6	5	5	16
57. Carrick L.	6	5	3	14
58. Todd L.	6	5	3	14
59. Lori G.	6	6	6	18
60. Lisa B.	6	5	6	17
61. Katherine E.	6	5	6	17
62. Tim H.	6	5	6	17
63. Marci S.	6	5	3	14
64. Tanya M.	6	5	4	15
65. Lewis T.	6	5	4	15
66. David G.	6	5	3	14
67. Holly S.	5	6	4	15
68. Eric T.	5	4	2	11
69. Matt B.	5	6	5	16
70. Mike D.	5	4	3	12
71. Joey M.	5	4	3	12
72. Kendra G.	5	4	3	12
73. Tony M.	5	4	5	14
74. Lonnie P.	5	4	3	12
75. Vangie W.	5	4	5	14
76. Kristie D.	5	4	6	15
77. Tammy J.	5	4	5	14
78. Kim C.	5	4	6	15
79. Michelle M.	5	4	4	13

Table 12 (continued)

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
80. Christine S.	5	4	3	12
81. Lesley M.	5	4	3	12
82. Chuck H.	5	5	5	15
83. Jimmy C.	5	4	3	12
84. Kim B.	5	4	5	14
85. Jason W.	5	4	4	13
86. Diane G.	4	4	3	11
87. Kim H.	4	4	4	12
88. Heather G.	4	4	4	12
89. Casey J.	4	4	6	14
90. Pete H.	4	5	2	11
91. Wes M.	4	4	4	12
92. Melinda B.	4	4	4	12
93. Jeff P.	4	5	4	13
94. Kate J.	4	5	2	11
95. Travis B.	4	4	3	11
96. Eric R.	4	4	4	12
97. Amie M.	4	4	3	11
98. Kathy H.	4	5	3	12
99. Rae Jean R.	4	4	2	10
100. Kristen D.	4	3	4	11
101. Heidi R.	4	4	3	11
102. Joe B.	4	3	3	10
103. Nicky Y.	4	4	3	11
104. Tim H.	4	5	3	12
105. Samuel D.	4	4	3	11
106. Freeman C.	4	4	3	11
107. Angela P.	4	3	4	11
108. James	4	3	2	9
109. Dean R.	4	4	4	12
110. Dustona H.	2	2	2	6
111. Chad N.	2	2	2	6
112. Deanna H.	2	2	2	6
113. Alison S.	2	2	2	6
114. Jamey S.	2	2	2	6
115. Marty H.	2	2	4	8
116. Zackary Q.	2	3	2	7
117. Brian W.	2	2	2	6
118. Melissa D.	2	2	2	6
119. Carl E.	2	2	2	6
120. Chad R.	2	3	2	7
121. Jason H.	2	2	2	6

Table 12 (continued)

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
122. Kim C.	2	2	2	6
123. Nancy C.	2	2	2	6
124. Scott R.	2	3	3	8
125. Shannon J.	2	2	2	6
126. Lanny F.	2	3	2	7
127. Lisa B.	2	2	2	6
128. Kerry W.	2	2	2	6
129. Rose Marie N.	2	2	2	6
130. Julie B.	2	3	2	7
131. Neoma H.	2	2	2	6
132. Angie E.	2	2	2	6
133. Scott W.	2	2	2	6
134. Tanya B.	2	2	5	9

Table 13

Scores of Children Assigned by Three Judges Using Evaluation Instrument

Grade Level:	Problem:	Media:
5.1	Color and Design: Divide Negative Space into Varied Shapes Relating to Central Object	Ink, Oil Pastel, Shellac and Scratching

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
1. Terry W.	5	5	5	15
2. Kirsten S.	5	5	5	15
3. Julie S.	4	4	4	12
4. Andy G.	2	2	2	6
5. Matthew S.	4	4	4	12
6. Jim K.	1	1	1	3
7. Shane G.	4	4	5	13
8. Sherri T.	2	2	2	6
9. Dominic B.	4	4	4	12
10. Christine D.	4	4	4	12
11. Sue Ann T.	3	4	3	10
12. Todd S.	6	6	6	18
13. Leanne N.	4	4	4	12
14. Michael O'D.	4	4	4	12
15. Thomas H.	3	3	3	9
16. Robert L.	3	3	3	9
17. Tom S.	4	4	3	11
18. Rob Y.	3	3	3	9
19. Andy L.	4	5	4	13
20. Amy T.	3	4	3	10
21. David H.	3	3	3	9
22. Lori H.	3	3	3	9
23. Terry M.	6	6	6	18
24. Kelly A.	5	6	6	17
25. Danny J.	3	4	3	10
26. Ron W.	2	2	2	6
27. Todd B.	4	4	4	12
28. Jana T.	2	3	2	7
29. Robbie McC.	5	5	4	14
30. Jenny M.	4	4	4	12
31. Kelly E.	5	5	4	14

Table 14

Scores of Children Assigned by Three Judges Using Evaluation Instrument

Grade Level:	Problem:	Media:
5.2	Sculpture of Imaginary Animal: Texture Study	Paper

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
1. Bill L.	6	6	6	18
2. Tracy S.	5	5	5	15
3. Mark W.	6	6	6	18
4. Kristie M.	3	4	4	11
5. Beth C.	5	6	5	16
6. Scott B.	5	6	4	15
7. Mike B.	2	3	2	7
8. Troy P.	5	5	4	14
9. Kent F.	6	6	6	18
10. Danny H.	3	4	3	10
11. Lisa T.	4	4	4	12
12. Carrie N.	5	5	5	15
13. Lori D.	3	4	4	11
14. Katie G.	4	4	4	12
15. Dawn S.	4	5	5	14
16. Carrie L.	3	5	3	11
17. Doug C.	3	3	4	10
18. Keith R.	2	3	2	7
19. Heather K.	2	3	2	7
20. Stacy I.	6	6	6	18
21. Mike W.	6	6	6	18

Table 15

Scores of Children Assigned by Three Judges Using Evaluation Instrument

Grade Level:	Problem:	Media:
6.1	Value Study: Drawing of Still Life	Graphite and Pencil

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
1. Karen S.	4	5	4	13
2. Missy D.	4	5	4	13
3. Todd S.	4	5	5	14
4. Jana T.	4	5	4	13
5. Robbie Mc.	5	6	6	17
6. Jean R.	4	4	3	11
7. Ray N.	5	5	4	14
8. Kevin R.	5	4	3	12
9. Jennifer Q.	6	5	5	16
10. Andy L.	6	5	4	15
11. Jim C.	2	3	2	7
12. David H.	2	3	2	7
13. Doug H.	6	4	5	15
14. Todd B.	3	4	3	10
15. Jenny M.	6	6	6	18
16. Casey C.	3	4	3	10
17 Debbie D.	6	6	6	18
18. Rick Y.	5	4	4	13
19. Ronnie W.	6	6	6	18
20. Matt S.	5	5	3	13
21. Thomas M.	3	4	3	10

Table 16

Scores of Children Assigned by Three Judges Using Evaluation Instrument

Grade Level:	Problem:	Media:
6.2	Collage Portrait: Balance in Color Relationship and Contrast in Texture, Solid and Pattern	Fabric, Yarn

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
1. Leigh S.	4	4	3	11
2. Tina M.	3	3	3	9
3. Vanessa B.	3	4	3	10
4. Eddie K.	2	3	3	8
5. Glenn B.	2	3	3	8
6. Bobby N.	2	3	3	8
7. Sharon T.	3	3	3	9
8. Chip W.	4	4	3	11
9. Troy W.	4	4	3	11
10. Joe F.	3	3	3	9
11. John McG.	3	3	3	9
12. Rhonda Sue C.	4	4	4	12
13. Beth W.	5	5	4	14
14. Craig H.	3	4	4	11
15. Kathy K.	5	5	4	14
16. Lisa J.	3	3	4	10
17. Tom C.	3	3	4	10
18. Chris G.	5	5	4	14
19. Trinda McC.	5	5	5	15
20. Janice N.	5	5	5	15
21. Martha O.	5	3	2	10
22. Tom P.	5	4	3	12
23. Quentin O.	4	4	4	12
24. Phil D.	5	5	6	16
25. Susan C.	6	6	6	18
26. Jennifer F.	4	4	4	12
27. Russell H.	2	3	3	8
28. Joe W.	3	3	3	9
29. Jim C.	4	4	4	12
30. Latha C.	4	4	4	12

Table 16 (continued)

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
31. Tony B.	6	5	4	15
32. Daniel J.	4	4	4	12
33. Gary F.	5	6	4	15
34. Randy S.	3	4	6	13
35. Melissa L.	3	3	3	9

Note. This problem involved a study of how each facial feature is composed. Each feature was constructed of several smaller shapes, and it was hoped this discovery would transfer into the children's drawing.

Table 17

Scores of Children Assigned by Three Judges Using Evaluation Instrument

Grade Level:	Problem:	Media:
6.3	Drawings: Close Observation of Detail	Pen, Ink

Names of Children	Individual Scores Judge 1	Judge 2	Judge 3	Composite
1. Tony B.	4	4	4	12
2. Melissa L.	3	3	3	9
3. Jimmy C.	5	5	5	15
4. Michael P.	3	3	3	9
5. Kristi G.	4	4	3	11
6. Tammy T.	4	5	3	12
7. Russ H.	3	4	4	11
8. Crystal R.	5	5	4	14
9. Lya K.	3	4	3	10
10. Terry C.	3	4	4	11
11. Candy W.	4	4	4	12
12. Rodney L.	3	4	4	11
13. Fred T.	2	3	2	7
14. Rodney S.	4	4	4	12
15. Rhonda Sue C.	5	6	4	15
16. Chip W.	5	5	5	15
17. Daniel J.	4	4	5	13
18. Brian E.	4	4	4	12
19. Trinda M.	5	4	4	13
20. Robert C.	1	2	2	5
21. Tony E.	4	4	4	12
22. Jeff V.	3	3	3	9
23. Pat A.	4	4	4	12
24. Frank W.	3	3	3	9
25. Brad P.	3	4	4	11
26. Beth E.	5	5	4	14
27. Latha C.	3	3	2	8
28. Brad S.	2	3	3	8

Note. To learn a new technique and to increase skills of observation were the major objectives of this problem.

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